

REGIONAL POLICY IN THE EUROPEAN UNION AND BRAZIL

An evaluation of regional development funds in Brazil



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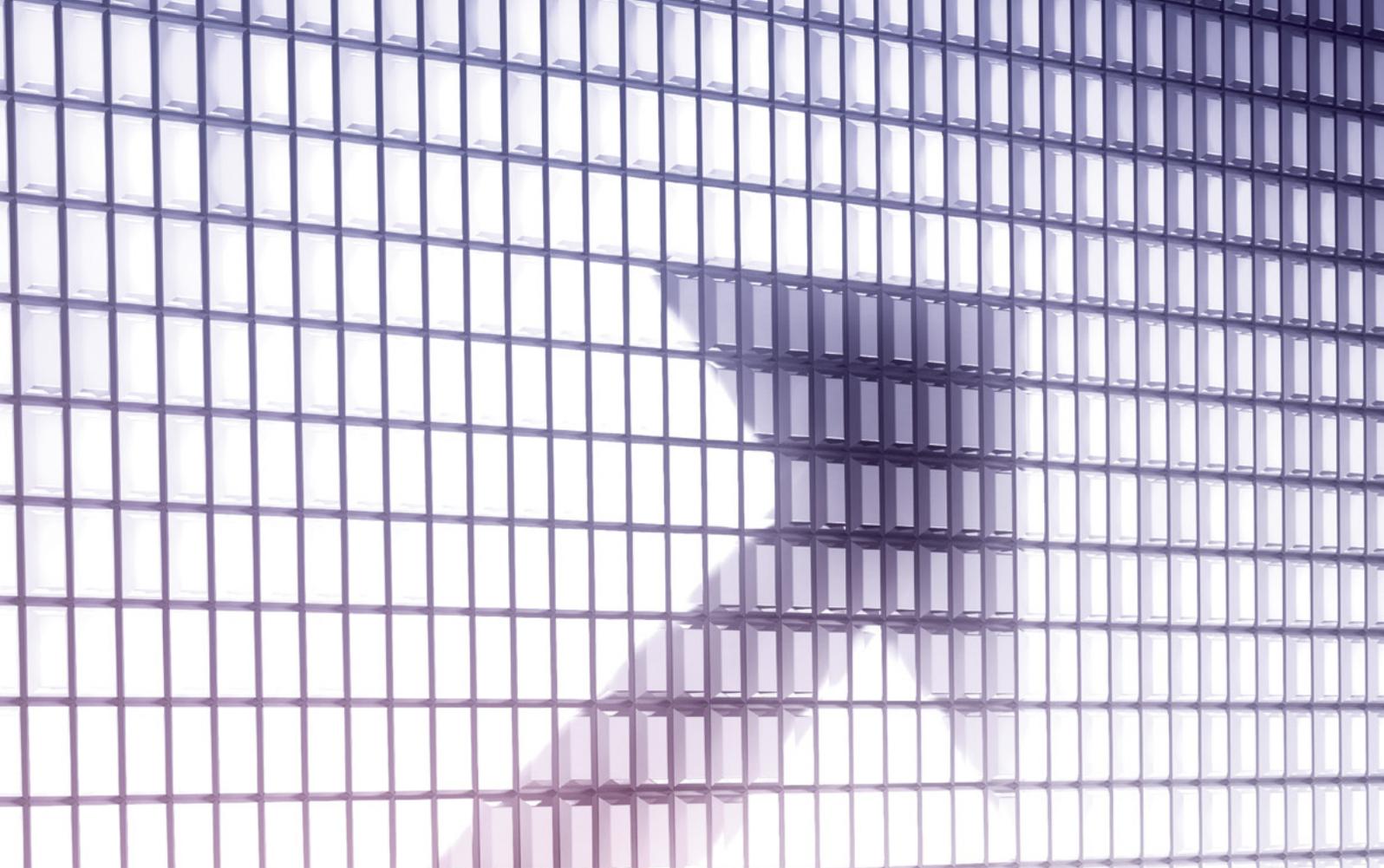
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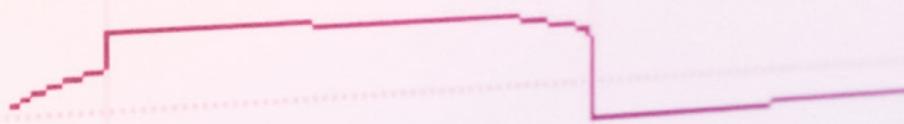
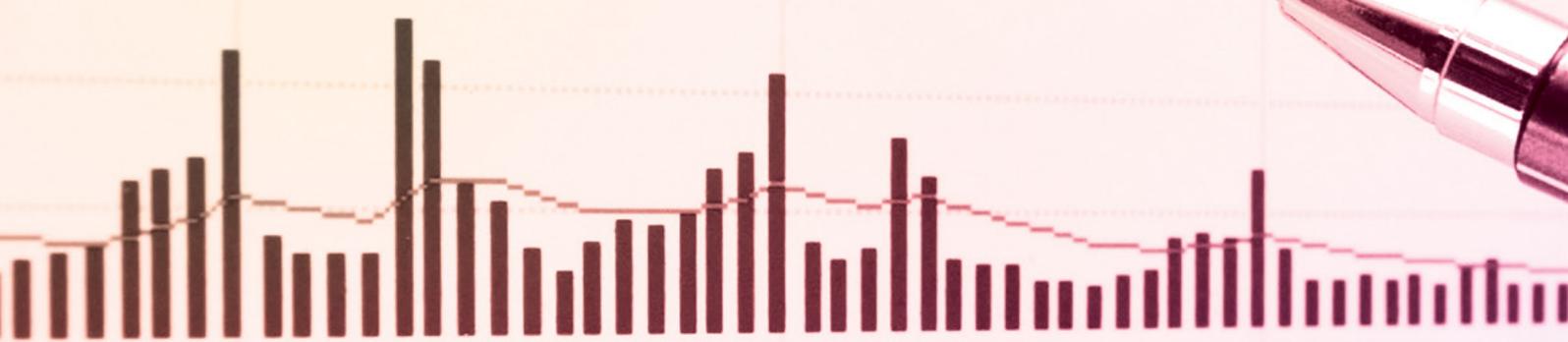
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FOREWORD

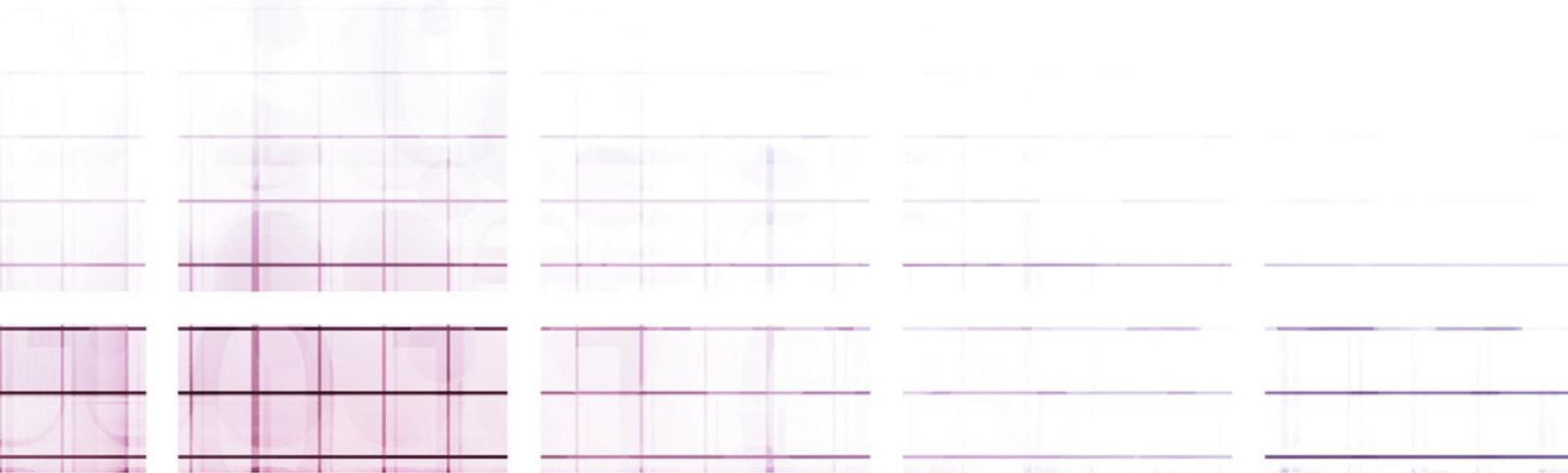
The Sector Dialogues are a new form of cooperation dynamics between the European Union (EU) and emerging countries. The initiative encompasses support for various initiatives based on the principles of reciprocity and complementarity, aiming to foster the exchange of experiences in areas of mutual interest.

The EU-Brazil Sector Dialogues Support Facility was created with a view to contributing to the advancement and enhancement of the strategic partnership and bilateral relations between Brazil and the EU, by promoting cooperation in areas of mutual benefit. The project is coordinated jointly by the Brazilian Ministry of Planning, Budget and Management – through the National Project Directorate – and the Delegation of the European Union to Brazil (DELBRA). In this context, Regional Policy is an interesting area for cooperation as it is an important instrument used to reduce social and economic inequalities in Brazil and in the European Union alike.

This publication is the result of the Sector Dialogue suggested by the Ministry of National Integration together with the Institute of Applied Economic Research (IPEA). The result is a study that provides an account of the state of regional policy in the European Union and Brazil and presents new findings for the Brazilian reality incorporating new aspects that are important to evaluate regional policies. Particularly, the report assesses the economic impacts of the Brazilian Constitutional Funds, which are the main instrument for promoting and financing the National Regional Development Policy.

All partners in this initiative hope that the publication of this report will contribute to refining regional policies in Brazil and in the EU. As the two economies have similar challenges in this area, effective cooperation can be achieved through learning from their experiences in order to design more effective regional policies that are able to deliver social and economic development.





INTRODUCTION

This report contributes to the dialogue between the European Union and Brazil regarding regional policies. Both economies present striking regional economic and social disparities and an active effective dialogue might benefit future design of regional policies in the EU and Brazil alike.

The document devotes two chapters to the EU regional policy followed by two additional chapters on the Brazilian regional policy. The first chapter provides a historical perspective and assessment of the regional policy in the EU. It assesses the regional policy and its impact on economic and social cohesion across its member states mainly through the lens of monitoring and evaluation efforts of the European Commission.

The second chapter provides an academic literature review about the effects of Regional Policy on reducing regional disparities across the EU member states. The report reviews mainly studies that deal with the so-called economic convergence phenomenon, which is a goal pursued by the EU regional policy and supported by its structural funds. The chapter seeks to report the overall stylized facts about the effectiveness of regional policy in the EU.

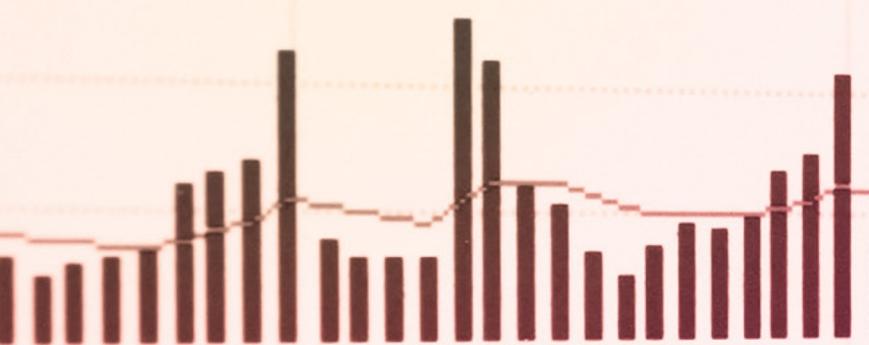
The third chapter presents a discussion about the goals of the regional policy in Brazil and the evidence of the impact of the constitutional funds on growth. The constitutional funds for the Northeast (FNE), the North (FNO), and the Central-West (FCO) are the main instruments of the regional policy. The chapter concludes presenting a discussion about the challenges that can contribute to a better monitoring and evaluation of constitutional funds.

The fourth chapter is the only empirical part of this report and evaluates the economic impact of the constitutional funds using a unique and recent data provided by the Brazilian Government. The study uses the spatial scales of municipalities and micro-regions to analyse the impact of Regional funds on GDP per capita growth between 2004 and 2010 taking into account the possibility of spillover effects of the regional policies by using spatial econometrics.

The last section concludes assessing the main findings of the effectiveness of regional policies in Brazil and the EU. Furthermore, the conclusion highlights common challenges of the regional policies in both economies.



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1. REGIONAL POLICY IN THE EUROPEAN UNION

This chapter aims to provide a historical perspective and assessment of the regional policy in the European Union (EU). The chapter assesses the regional policy and its impact on economic and social cohesion across its member states mainly through the lens of monitoring and evaluation efforts of the European Commission. In order to understand regional policy in the EU and appraise its contribution it is necessary to describe its evolution and adaptations made to cope with additional problems emerged from the enlargement process. This historical perspective of the EU regional policy is described in section 1.1 of this work. Section 1.2 analyses the main objectives of the EU regional policy which have been approved along the Treaties, focusing on the role of the European Cohesion Policy. Section 1.3 explains the impact of the EU regional policy as it has been assessed by the European Commission through the official reports and studies. We analyze some stylized facts and statistics that make clear the contribution of the Cohesion Policy as well as the reforms on the regional policy taken place over time. Last section 1.4 concludes on the role of regional policy to reduce regional disparities and to achieve economic and social cohesion across the Union.

1.1. HISTORICAL PERSPECTIVE OF REGIONAL POLICY IN THE EU

Large regional inequalities can seriously threaten the integration process in Europe and the economic

and social cohesion goals necessary for the creation of a harmonious Europe without regional asymmetries. For this reason Regional Policy in the EU is an important instrument to reduce regional disparities among its member states and lead to a faster convergence. The EU uses about one third of its total budget to run Cohesion Policy with the objective of promoting overall harmonious development and in particular to reduce regional disparities across the Union. This is done under the general belief that market forces are unable to achieve such a balanced result in terms of regional development in advanced integrated markets where not all regions can be able to take advantage of economic liberalization (Marzinotto, 2012).

According to Li Gang (2012), Regional Policy in the EU has been modified and adjusted to cope with the new reality of higher regional asymmetries aggravated with the successive process of enlargements and deeper integration in Europe.

Initial stage 1957 [6 founder countries: Germany, France, Italy, Belgium, Luxembourg, and the Netherlands]

In 1957 the Treaty of Rome established the need to strengthen the economic unity of the initial 6 state members and to ensure their harmonious development by reducing regional asymmetries and the backwardness of the less-favored regions. To this end, two special sectoral funds were created: The European Social Fund (ESF) in 1958 and the European Agricultural Guidance and Guarantee Fund (EAGGF) in 1962 the former assisting poor regions with low per capita income and high unemployment rate, the latter assisting rural areas to improve agricultural structures.

First enlargement 1972 (6 founders + Denmark, Ireland and the U.K)

The first enlargement increased regional disparities in the European Community. Regions of north England and north Ireland were suffering from lower per capita income and higher unemployment. The first oil crisis in 1973 worsened regional disparities within the Community and it was in 1975 that the first explicit fund for regional income redistribution was created, the so called European Regional Development Fund (ERDF). This fund aimed at redistributing part of the Member States' budget to the poorest regions and financing infrastructure networks, job creation investment, local development projects and aid to small firms to continue with their activity. The setting up of this fund is viewed as the origin of the regional policy in the European Community and shifted the focus of attention from countries to regions and aimed at providing assistance to potential losers.

Second and Third enlargement (9 previous + Greece (1981) +Portugal and Spain (1986))

The accession of Greece, Portugal and Spain to the European Community farther increased regional disparities since these countries had per capita income significantly lower than the previous Member States (with the exception of Ireland). To solve this challenge the European regional policy decided to redesign its policy which can be summarized as follows: (i) in 1988 the so-called Structural Funds (SF) created which integrated the previous three funds, namely the ESF, EAGGF and ERDF; (ii) established 4 key principles for the distribution of funds, that is, concentration, multi-annual programming, additionality and partnership;

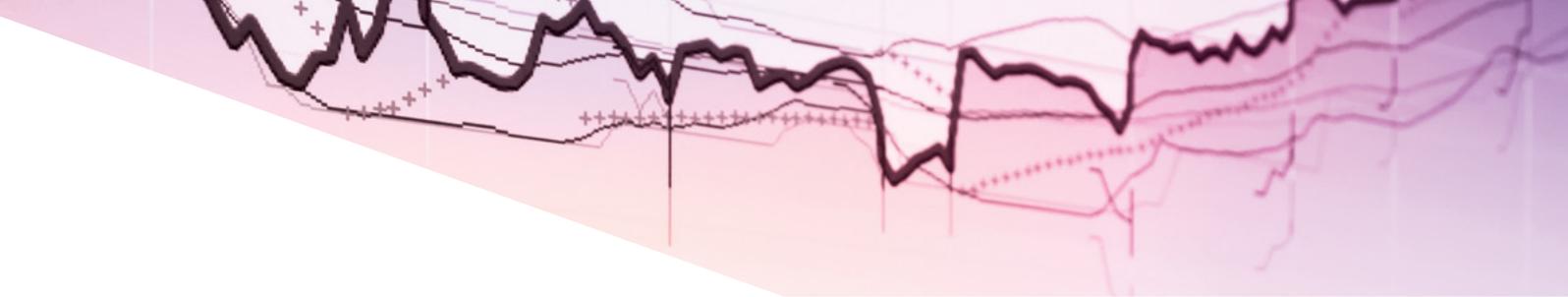
(iii) defined 5 main objectives and 16 Community Initiatives¹.

The German re-unification in 1990 is another type of internal enlargement that aggravated even more regional asymmetries. 17 million people were added whose per capita income in real terms was only 35 percent of the EU average. Structural Funds supported the costs of the German re-unification. In 1992 the Maastricht Treaty was signed and established the European Union and the nominal criteria for the creation of the European Monetary Union (EMU) in 1999.

The Structural Funds contribution have grown from €8 billion per year in 1989 to €32 billion in 1999 and more than 2/3 of the SF budget is allocated to helping areas which are less developed (European Commission, 2008).

The SF policies, according to Mari Penalver (2007), have been designed on the basis of three basic assumptions: (i) the existence of regional asymmetries in the EU, (ii) structural policies are able to reduce these asymmetries, (iii) regional

1. The Objective 1 is the main priority involving regions with per capita income below 75% of the Community average and share some identical economic indicators, such as, low level of investment, higher unemployment than the average, lack of services for business, poor basic infrastructures, among others. Aims to promote the development and structural adjustment of regions whose development is lagging behind the rest of the EU (its share is 67.6% of total SF). Objective's 2 goal is to convert regions seriously affected by industrial decline (with 11.1% share of total SF). Objective's 3 task is to combat long-term unemployment and facilitate the integration into the labor force of young people and those exposed to exclusion from the labor market. Objective 4 aims to facilitate the adaptation of workers to industrial changes and to changes in production systems (Obj. 3 and 4 with 10.9% share of total SF). Objective 5 (with 4.9% share of total SF) facilitates the development and structural adjustment of rural areas and Objective 6 is assisting the development of sparsely populated regions (with 0.5% share of total SF involving Sweden and Finland only).



growth and convergence leads to economic and social cohesion.

The Cohesion Policy of the EU came into existence shortly after this enlargement. It was believed that market integration increases regional disparities, as mobile factors of production (especially capital) move to core developed regions where returns to investment are higher (Padoa Schioppa, 1987). The neoclassical idea of absolute convergence was abandoned or rather associated with the endogenous growth theory and the economic geography literature, arguing that free markets generate agglomeration tendencies (therefore income disparities) because economic activities concentrate in technologically more advanced developed areas. Therefore, regional policy was necessary to reduce the unequal development of regions, and the EU Cohesion Policy aims to create the conditions for increased returns to investment also in the periphery through the provision of collective goods such as infrastructures, information networks, research and development, better human resources.

Fourth enlargement 1995 (12 previous + Finland, Sweden and Austria)

The fourth enlargement brought into the EU three more developed countries widening therefore regional disparities. A second reform of regional policy came into force implying the following measures: (i) two new financial instruments were created, namely the Financial Instrument for Fisheries Guidance (FIFG) and added to Structural Funds (SF), and the Cohesion Fund (CF) is designed to assist Member States with per capita income less than 90% of the Community average; (ii) it was added a new objective 6 to assist regions with an extremely low

population density (Finland and Sweden); (iii) the Committee of the Regions (CR) was created which is an advisory institution for regional policy-making, comprising local and regional representatives from all the member states.

Fifth eastern enlargement 2004 (15 previous + Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia, Malta and Cyprus)

This deeper new enlargement increased significantly economic disparities between regions, since the average per capita income of these countries was only 43.7 percent of the EU 15 average. In terms of regional policy reforms the objective was to simplify the previous instruments: (i) there was a reduction of the Structural Funds Objectives from 6 to 3² and the number of Community Initiatives from 13 to 4; (ii) the creation of two new pre-accession instruments, namely, the Instrument for Structural Policy for Pre-Accession (ISPA) and the Special Accession Program for Agriculture and Rural Development (SAPARD).

For the period 2000-2006 the EU has placed a total of €195 billion to the SF programs which accounts

2. Objective 1, "convergence" – aims to accelerate the economic convergence of the regions of the EU where per capita GDP is below 75 per cent of the EU average; it works through the ERDF, the ESF and the Cohesion Fund and represents 81.5% of the resources allocated to the structural funds; known as "Objective One"; Objective 2, "regional competitiveness and employment" – aims to improve regional competitiveness and employment through the promotion of innovation, entrepreneurship, environmental protection and the development of labor markets; this objective includes regions which are not covered by the convergence Objective 1. It is financed through the ERDF and the ESF, and represents 16% of regional fund spending. Objective 3, "European territorial co-operation" – aims to strengthen the co-operation at cross-border, transnational, as well as inter-regional levels, in the fields of urban, rural and coastal development, and foster the development of economic relations and networking between small and medium-sized enterprises (SMEs). The smallest of the objectives in terms of resources, it is financed by the ERDF and represents 2.5% of structural funds spending.

for approximately 1/3 of the total EU budget (European Commission, 2008).

Sixth enlargement 2007 (25 previous + Bulgaria and Romania)

With the last two enlargements the economic and social disparities in the EU have largely been deepened. To have an idea, the wealthiest EU member the Luxemburg is seven times richer than the poorest one, Romania. At the regional level the differences are even higher, the richest region is Inner London (financial centre) with per capita income 290% higher than the EU 27 average level and the poorest is Nord-Est Romania with 23% of the EU average. In order to cope with these asymmetries, the EU proceeded with the 4th reform during the period 2004-2006 which involves the following steps: (i) integrate the previous Objectives and the Community Initiatives into three main Objectives: Convergence, Regional Competitiveness and Employment, and European Territorial Cooperation; (ii) reducing the number of financial instruments for cohesion from 6 to 3, ERDF, ESF and the Cohesion Fund; (iii) creating a simpler Instrument for Pre-accession Assistance (IPA); (iv) establishing the European Grouping for Territorial Cooperation (EGTC) which will enable to develop cross- border transports and health services.

The Cohesion Policy assistance for the period 2006-2013 was around €308 billion equivalent to only 0.37% of the GNI of the EU27. The New Member States received 51.3% of total cohesion policy resources corresponding to 3.5% of their GDP (European Commission, 2010).

As it can be seen, the various enlargements have contributed to increase regional asymmetries in the EU and therefore, regional policies had to be

reformed and adjusted in order to achieve higher convergence within the EU member states and between regions.

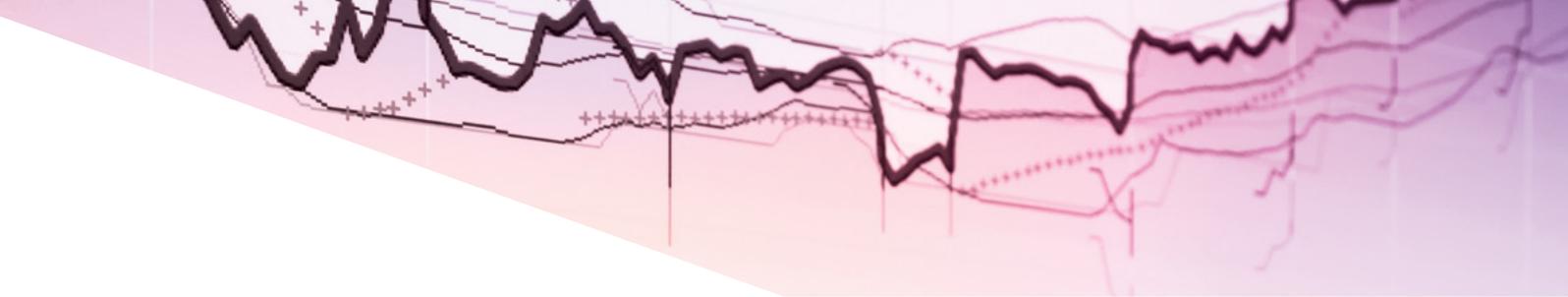
1.2. REGIONAL POLICY AND GENERAL OBJECTIVES

The main purpose of Regional Policy in the EU through the European Cohesion Policy is to reduce regional disparities across the Union by co-financing growth enhancing investment in infrastructure, human capital and innovation, creating therefore conditions for further growth, particularly in the less developed regions and member states.

Regional policy has been changed over time and reforms have been made taking into account the following aspects (Laura Polverari and John Bachtler, 2004):

- (i) Targeting both equity and efficiency, shifting the policy orientation from spatial redistribution to regional competitiveness
- (ii) Favoring supply-side instruments and local economic development initiatives
- (iii) Stronger spatial but also sectoral targeting of resources and reducing the use of regional aid (moving from redistribution effects to competitiveness effects)
- (iv) Using mechanisms that give a greater role to local public and private actors
- (v) Developing a multi-annual strategic framework

In essence, regional policies have gradually moved from the distributive to the competitiveness strategy which is in line with the endogenous growth theory



and the new economic geography, based on the mobilization of local potential resources. It is the stock of regional resources (physical, human, social and environmental endowments) that are crucial for regional competitive advantages turning the investment more efficient in one region than in other. Factors like, geographical location, the size of the region, climate, natural resources, quality of life, potential economies of scale, factors that can reduce transaction costs (access to knowledge and information), local and regional traditions and customs, local institutions, and some intangible factors, such as rules, practices, producers, consumers, researchers and policy-makers, can all contribute to the development of creative and innovative activities.

Regional policy in the EU is changing from traditional policies based on subsidies, state aid and redistribution to the development of strategies assessing the capacities of a region with the aim to increase regional competitiveness. Emphasis must be given on stimulating endogenous development by providing support to areas of comparative advantages, rather than compensating regions for disadvantages. The redistribution of growth opportunities is not the sole objective of the EU cohesion policy, since rich regions receive funding too. It is estimated that around 16% of the Cohesion spending is allocated to relatively high-income regions to improve their competitiveness and employment conditions.

The Lisbon agenda approved in March 2000 contributes to shaping the regional policy giving emphasis to the competitiveness aspects of regions. The objective was to turn the EU the most competitive and dynamic economy of the world within the framework of sustainable development and social inclusion. However this ambition was

postponed due to the financial crisis in 2008 and the consequent debt crisis of the peripheral EU countries resulting in economic recession and unemployment of the affected members.

Cohesion policy in general has helped to improve economic, social and environmental conditions in the Union. Focusing on a few key priorities, especially in the more developed regions, would be the most effective policy; therefore, Cohesion Policy should become more selective. Future programs should concentrate on only few priorities, so that each priority should receive enough funding to deliver a real impact subject to a more careful monitoring progress. These priorities should be identified developing a close collaboration between the European Commission, the member states and its regions. Incentives would reward regions and countries that have performed well and reached agreed European objectives.

The Cohesion Policy proposed for the period after 2013 allows all member states and regions to actively develop smart, sustainable and inclusive growth. The Commission will consider the difficulties and potential for growth regions, such as urban deprived neighborhoods, regions under economic restructuring and more generally the necessity to shift to a more innovative and knowledge based economy based on a better educated workforce.

1.3. EVALUATION OF THE ACHIEVEMENTS

The European Commission publishes multi-annual reports exposing the results obtained from the application of regional policies and the objectives of economic and social cohesion across its

member states. There are in total five Reports of the Commission (started in 2001) which despite the achievements explain the new orientations for farther cohesion across the Union. We will present the results and conclusions of the latest more updated report on the cohesion policy.

1.3.1. THE EUROPEAN COMMISSION REPORT

The Fifth report on Economic, Social and Territorial Cohesion (2010) is adopted having into account the financial and economic crisis in recent years. This report is the first adopted under the Lisbon Treaty (2000) which added *territorial cohesion*³ to the initial goals of economic and social cohesion. The Report analyses the territorial dimension of access to services, it pays more attention to climate change and the environment, and considers how the territorial impact of policies can be measured. In general, the Cohesion Report is to support the Europe 2020 strategy for long-term recovery with the key objectives of *smart, inclusive and sustainable* growth and highlight the contribution that regions, and Cohesion Policy, can make to meet these objectives. The main conclusions of the Report are the following:

Infrastructures and Institutions

Innovations lead to more growth if infrastructures are developed to transfer technology easily to wider markets. Within the EU, this requires establishing a single digital market and increasing access to broadband. According to the European Commission Report, in less populated areas in Romania only

13% of households had a broadband connection in 2009, compared to 77% in Finland.

Transport infrastructures are important for trade and labor mobility and contribute to regional convergence. These infrastructures are asymmetrically distributed across the EU. Most central and eastern member states still have fewer motorways than others and lower speed on their rail networks. Access to air transport in most of these members is also poor due to fewer flights and poor connections to airports. Border regions connections are also poor and these regions have less access to services and markets, especially along the external borders.

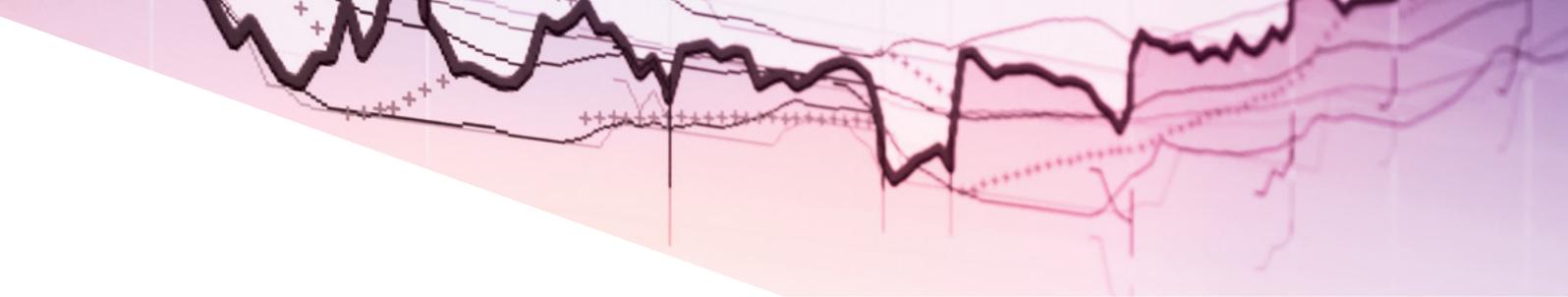
Strong institutions are crucial for sustainable growth and social welfare. Macroeconomic stability, fiscal consolidation, productive public investment, development of e-government services help to increase the transparency and efficiency of public administrations even cross-border and inter-regional cooperation.

Education and innovation targets

Improvements on education and innovation must be improved since at a regional level differences are huge. Only one in six regions the education target of 40% of those aged 30-34 with tertiary or equivalent education degree has been reached, as the Europe 2020 target defines. Only one in four regions the target of at most 10% of young people aged 18-24 with no education beyond basic schooling has been achieved which requires a substantial effort for improvement, especially in Malta and regions in Spain and Portugal where the rate is still above 30%.

To become more productive the EU needs more innovation, more investment in education, training

3. Some policies have clear territorial dimensions, like transports or environment policies. Other have a partial territorial dimension, such as research, information society or health policy.



and life-long learning. Only one region in ten has reached the Europe 2020 target of investing 3% of GDP in R&D. In most regions the focus should be on absorbing and spreading innovative practice developed elsewhere, than on new innovations. These regions need to support investment in firms that have the capacity to internalize innovative practices and train their work force to assimilate the new technologies. Also strengthening the links between private enterprise, research centers and local authorities is important for achieving the goals of regional development.

Wellbeing and social inclusion

The EU has one of the highest life expectancies in the world but also has an elderly population and low birth rates. These tendencies have consequences for both the health services and the labor force, increasing the demand for health care and destabilizing the social security system. However differences in these wellbeing standards are substantial among member states and across regions due to differences in income, education, unemployment and living conditions.

Although substantial improvements have been made in unemployment rates between 2000 and 2008, after the financial crisis and the fiscal consolidation measures, unemployment has risen dramatically in some EU countries, notably in Spain (27%), Greece (30%), Ireland (15%), Portugal (17%) and the Baltic States (12%). Employment rates of women are considerably lower than men and unemployment is higher between women than among men, besides the fact that women have achieved higher levels of education. Considerable efforts must be made through regional policies (structural funds) to bring people back to work investing in job creation projects.

Labor mobility in the EU remains low, which impedes the reduction of large regional disparities in unemployment. Migration patterns are different in the UE but a common characteristic is that migration moves from rural areas to the urban zones. Outside migration is the most important source of population growth but problems with social integration are considerable.

In most of the developed member states access to services, such as education, health care, banking, social security system, justice etc. is easier in comparison to less populated areas where this access is more limited. However more populated urban areas suffer from problems like crime, violence, vandalism, pollution and noise.

Europe 2020 targets aim to reduce poverty and exclusion. Severe material deprivation is one indicator used to measure poverty and this phenomenon is mostly found in less developed member states and regions where up to quarter of people are identified to be in this situation. Households with low work intensity is another measure of poverty and are most common in the UK, Hungary and Ireland, where at least one in 10 lives in such a situation and in Baltic States, Cyprus and Slovakia the number is less than one in 20. People with income less than 60% of national median disposable income are considered as being at the risk of poverty. Differences are larger among regions than across countries. The financial crisis after 2008 contributed to increase the rates of poverty in the EU countries. The role of regional policy is to promote active inclusion and reduce poverty by investing in education, training and skills, modernize labor markets, higher access to health services in order to build a cohesive society in the EU.

Enhancing environmental sustainability

Adapting to climate changes is another target of regional policies. Climate conditions have changed which has additional costs and affects mostly rural areas. On the other hand extreme weather events, such as droughts, floods, storms etc., can affect many cities and urban areas.

One of the Europe 2020 target is to reach a 20% energy consumption coming from renewable sources other than fossil, but this requires more investment in solar energy, particularly in southern Europe or in wind energy, especially in the Atlantic and North Sea coasts. Another target is to reduce greenhouse gas emission by 20% which also requires private and public investment. To increase energy efficiency requires investing in the insulation of buildings, more efficient heating systems and different modes of transports with low gas emission. Other policies can focus on waste water treatment especially in the eastern member states and recycling measures friendly to environment.

Public investment is critical to improving the competitiveness of less developed regions, especially regions with lack of basic infrastructures. At the empirical level, a number of studies have concluded that public investment enhances growth where good institutional governance is critical. Investment in infrastructure needs to be combined with investment in education, enterprise, and innovation to ensure that it has positive effects on development. Investment in R&D and businesses need to be complemented by investment in human capital to foster the efficiency of the regional innovation process and to ensure that the benefits of innovation are spread out in spatial and social terms. Cohesion policy is important to support Public investment in infrastructures in less developed

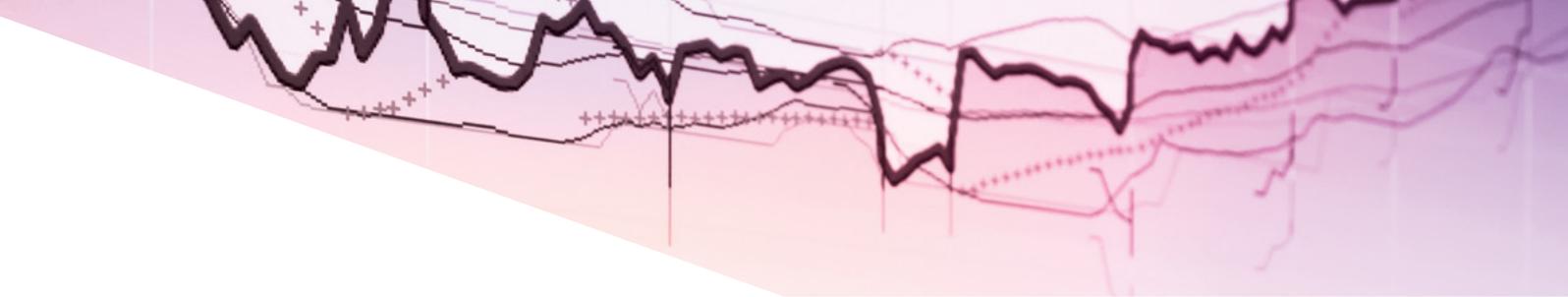
regions and to increase their growth potential helping them to converge with the more advanced regions..

1.3.2. MONITORING AND EVALUATION OF THE COHESION PROGRAMS

According to European Commission (2014), appropriate and rigorous methods are necessary to be developed for monitoring and evaluating the results obtained from the implementation of the cohesion programs. The success and relevance of monitoring and evaluation will depend on the commitment of the involved partners, between the member states, regions and the European institutions. For a program to be successful two essential tasks must be fulfilled: (i) to deliver (implement) the program in an efficient manner and (ii) to assess whether a program has produced the desired effects.

The so called task of *common indicators* at the EU level is to aggregate certain information across all programs in order to be accountable to the European Council, European Parliament, the Court of Auditors, and to European citizens on where Cohesion Policy resources are spend on. Monitoring also means to observe changes in the result indicators, whether or not they move in the desired direction. The values of *result indicators* can be obtained from national or regional statistics. In some cases it is necessary to carry out surveys, interviews, case studies or to use administrative data, such as registry of enterprises or unemployment benefit data.

To disentangle the effects of the intervention and understand the functioning of a program two processes can be used: (i) the *counterfactual*



impact evaluation assessing whether the public intervention had an effect (positive or negative), how big the effect was, and whether a causal link exists. Evaluation of this type are based on models of cause and effect and require a credible approach to control for factors other than the intervention that might account for the observed change; (ii) the *theory-based impact evaluation* assessing whether an intervention produced the intended effects, why and how it works, for whom and under what conditions. Ideally, both approaches should be used since they complement each other.

Implementation evaluations are also important and look at how a program is implemented and managed. Typical questions are addressed, like whether or not potential beneficiaries are aware of the program, whether they have access to it, if the application procedure is simple, if there are clear selection criteria, whether there is a documented management system and whether the results of the program are effectively communicated.

An ex ante evaluation is crucial in order to improve the quality of operational programs and should take into account the following aspects:

- the contribution of the Union strategy for smart, sustainable and inclusive growth considering national and regional needs
- the effectiveness and efficiency of the Funds and their impact on economic, social and territorial cohesion
- the consistency of the allocation of budgetary resources with the objectives of the implanted programs
- the relevance and clarity of the specific indicators proposed by the program

- how the expected outputs will contribute to the intended results
- whether the quantified target values for indicators are realistic
- the adequacy of human resources and administrative capacity to implement the program
- the suitability of the procedures for monitoring and collecting the necessary data to carry out the evaluations
- the adequacy of planned measures to promote equal opportunities and prevent discrimination

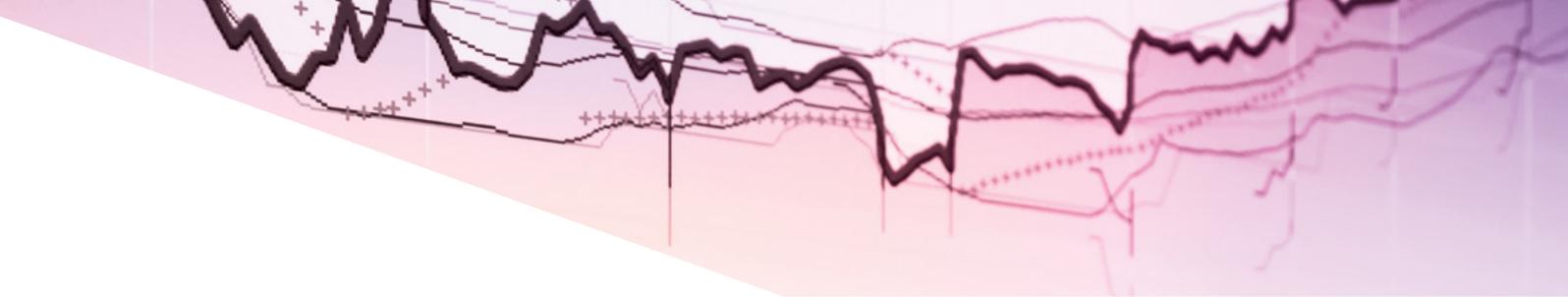
Annual monitoring and program implementation reports are crucial for the execution of operational programs. These reports should provide information on the stage of the implementation of the program, financial data, cumulative values for output indicators (achievements of former years), achievements of target values, and a synthesis of the findings of evaluations from the previous financial year.

1.3.3. THE IMPACT OF COHESION POLICY

The Structural Funds and Cohesion Funds are the main budgetary items of the European Union to support economic and social cohesion in the member states. Cohesion policy aim is to pursue harmonious or symmetric development across the Union. According to the Fifth Report of European Commission (2010), a variety of programs, projects and partners are used to achieve this goal. The period from 2000 to 2013 consists of two programming set-ups: (i) the first covers the 2000 to 2006 period where more than €250 billion was allocated and the main recipients were the cohesion

countries Spain, Portugal, Greece and Italy followed by East Germany and Ireland; (ii) the second programming period is from 2007 to 2013 where the total budget is around €308 billion and the main beneficiaries are under the Objective 1 supported areas, mainly new member states, Poland, Hungary and the Czech Republic followed by Bulgaria and Romania. The supports take the forms of grants, loans, venture capital, business advice, networking, innovation consortia, etc. Some results that have been obtained are the following:

- Over the period 2000-2006 around 1 million jobs were created in enterprises adding as much as 10% to GDP in Objective 1 regions in the EU-15.
- Various studies indicate that this policy tended to boost trade and exports of net contributors which helps to offset their contributions to funding the policy.
- The trade balance with the rest of the world has shifted from just being positive to just being negative over the last ten years. Trade in services has been growing fast and became positive underlining the strong global position of the EU in this area.
- Macroeconomic model simulations indicate that Cohesion Policy had net effects of raising the level of GDP in the EU as a whole
- The coefficient of variation, a common measure of disparities, fell from 42.7 in 1996 to 39.1 in 2007 in the EU showing a slight convergence.
- In the EU, productivity growth is the main source of growth in GDP per head and it was responsible for 80% of the growth which occurred in the period 2000-2007. In the Convergence regions (assisted by the ERDF) productivity grew by more than the EU average.
- The increase in Productivity growth was the result of improvements in productivity within sectors (innovation, R&D, human capital, management and organization techniques) and better allocation of resources between sectors shifting to higher value-added sectors.
- Cohesion Policy supports the training of around 10 million people a year, with a strong focus on young people, the long-term unemployed and the low skilled.
- Evaluation evidence has demonstrated that the active participation of people and organizations in projects at regional and local level is a crucial success factor.
- In terms of protecting the environment, more than half of the member states are tracking the reduction of greenhouse gas emissions respecting the programs for the period 2000-2013.
- More than 23 million people were connected to wastewater collection and treatment systems and around 20 million people connected to clean supply of drinking water through the ERDF and Cohesion Fund support.
- Programs must identify a limited number of policy priorities (concentration) with a clear view of how they will be achieved and whether they will contribute to the economic, social and territorial development of the regions.
- Monitoring and evaluation systems must be improved to ensure that objectives are attained.
- In general Cohesion Policy made a significant contribution on growth, employment and prosperity across the Union, reducing economic, social and territorial disparities. Undoubtedly, without Cohesion Policy, disparities would be greater.



According to the Fifth progress report on economic and social cohesion (2008), poorer regions in the EU are passing through a restructuring process that is shifting employment and economic activity to more productive and competitive sectors. European Cohesion Policy (ECP) is responsible from this shift towards higher value-added activities, through investments in better business infrastructure and services and better training programs of the labor force. ECP also supports strategic investment in R&D and innovation in the more advanced regions to cope with harder competitive challenges in global markets.

1.3.4. STYLIZED FACTS AND STATISTICS

According to Gáková Z. et al. (2009), European Cohesion Policy is one of the most important instruments that the EU has to support social and economic development assisting the less developed regions or countries. It provides financial support for investing in infrastructures, human capital improvements, innovation and R&D activities and in general investing on business environment.

Gáková Z. et al. (2009) provide an ex-ante assessment on the expected results of Cohesion Policy, stating that this Policy has both short-term effects due to *demand shocks* and long term effects due do *supply shocks*. The short-term effects occur during the program implementation period increasing domestic demand for goods and services, leading to increased production, creating more employment and higher income. Long-term effects are related to the increase of capital stock in infrastructures, improvements in human capital and innovation which strengthen the productive capacity of cohesion economies and contribute

to their external competitiveness. However, the impact of European Cohesion Policy differs from one country to the other, because of differences in the amount of resources transferred from the Union budget, the structure of the local economies, the kind of investment realized and other structural characteristics.

The European Cohesion Policy (ECP) assisting less developed regions and countries, through its programming investment induces a demand shock, which leads to more production and income, which in turn generates a further increase in demand and leads to additional production and income, in line with the Keynesian multiplier principle and the cumulative causation process. However, the Cohesion Policy has also supply-side effects, through the investment in infrastructure, human resources and innovation which increases the stock of physical and human capital and technology increasing therefore total factor productivity and productive capacity of the assisted economies. The supply-side impacts last longer, due to the spillover benefits of the improved stocks of physical infrastructure, human capital and R&D. During the implementation phase the ECP investment in infrastructures boosts public investment in the beneficiary economy. But also private investment increases during the implementation phase because (i) the aid to productive sectors of manufacturing and market services boosts sectoral investment and (ii) ECP assistance increases domestic demand that raises output and induces additional private investment.

Although the relative share of manufacturing (more than 20%) is smaller than the service sector (more than 50%), the former sector plays an important role in the development of the economies since most activity enhances the tradable sectors with higher

gains in productivity due higher increasing returns to scale. The manufacturing or industrial sectors are the major channel through which EU intervention affect the productivity and competitiveness of exports resulting in long-term growth. In general the service sector is mostly non-tradable and driven by domestic demand (the exception can be tourism).

To measure the impact of the Cohesion Policy on economic development the cumulative multiplier is used, defined as the cumulative percentage increase in the level of GDP from the beginning of the ECP intervention to the end of the program divided by the cumulative ECP funding amount as a percentage of GDP. Using this methodology and calibrating simulations up to 2020, Gáková Z. et al. (2009) found that the cumulative multipliers for the assisting countries range from 1.9 in Bulgaria to 3.9 in Estonia. The highest impact on physical infrastructure occurs in Poland (46.3%) and Latvia (42%) and the lowest in Cyprus and Spain (less than 4%). The highest impact on human capital is found in Bulgaria (16.3%), Latvia (14.5%) and Portugal (14.3%) and the lowest in Cyprus and Spain (less than 5%). The highest impact on innovation is in the three Baltic States (Latvia, 69%, Estonia and Lithuania 40.5%) and the lowest in Cyprus, Greece and Spain (lower than 5%). The impact of cohesion funding on the three capital stocks depends on the ECP budget allocated to the main categories of expenditures and the level of national investment in each category. The lower impact in the Mediterranean countries is explained mostly by the austerity programs after 2008 implemented to solve the debt problem and the higher impact in the Baltic countries is due to the recent entrance in the EU (since 2004) benefiting from larger transfers and starting from a lower level.

Bradley et al (2007) have shown that the assisted

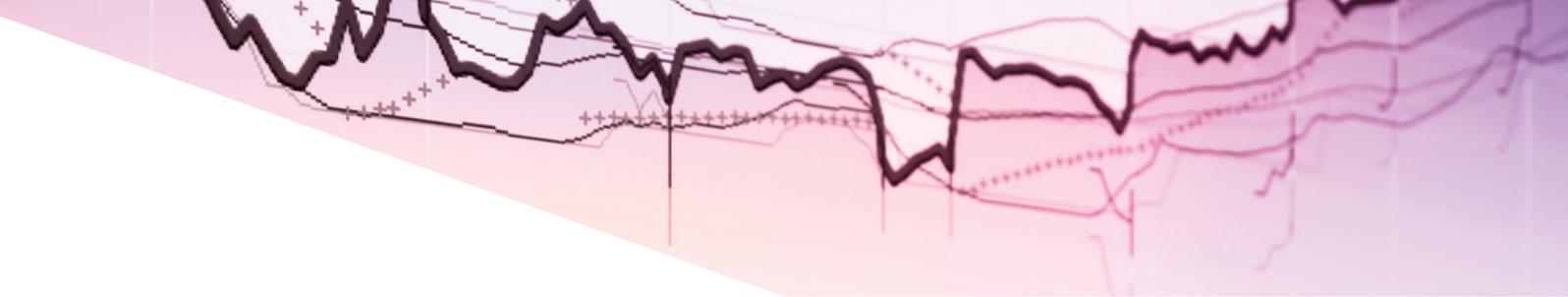
countries through the ECP budget can be divided into three groups, based on the ranking by the size of the cumulative multipliers:

- (i) High cumulative multipliers: Ireland (4.82), Romania (4.6), Czech Republic (4.38),
- (ii) Medium Cumulative Multipliers: Estonia (3.65), Lithuania (3.36), Latvia (2.78), Slovakia (2.62), Greece (2.47), Poland (2.39), Hungary (2.37), Spain (2.40), and Cyprus (2.21)
- (iii) Low Cumulative Multipliers: Bulgaria (1.87), Slovenia (1.86) and Portugal (1.84)

To derive these conclusions the authors use an approach that considers the “with-Cohesion Policy” simulations which then are compared with the “without-Cohesion Policy” baseline, and the differences are taken as measures of the Cohesion Policy impacts.

At a micro level Mouqué Daniel (2012) examines the results obtained from the assistance of EUR 40 billion given to 235000 firms in seven different member states in the 2007-13 programming period. The effects of this program are considered in terms of investment, productivity, employment and innovation. The findings of this study can be summarized as follows:

- (i) Financial support to small and medium-sized enterprises (SMEs) in less developed regions it is shown to be effective and seems to counter some kind of capital constraint. In particular it is found that every euro of public support is responsible for EUR 1.30 increase in investment. On the other hand the jobs created were of good quality and durable.
- (ii) The most effective supports were found



on business advice, networking abilities and measures to promote innovation

(iii) It was concluded that the positive results apply mostly to SMEs in terms of investment behavior since they are capital constrained. But large firms contribute more in terms of innovation networks and innovation consortia.

(iv) For medium-sized enterprises, innovation support, networking and innovation consortia proved effective at increasing long-term growth and productivity. For small and micro enterprises, basic business advice seems the most cost effective policy of support.

(v) Finally, it is necessary to make the programming policy more cost-effective by moving from a grant support to a loan support financial schemes (it is shown that loans are more effective than grants). Also supporting high added-value enterprises than low added-value business activities is a more effective policy.

In general the main effect of the classic grant schemes makes enterprises larger (investment broadening) rather than more efficient (investment deepening). But non-grant instruments (loan instruments, innovation consortia) are shown to have better results in promoting higher productivity.

The work of Mouqué (2012) provides a more rigorous impact evaluation related to the regional policy at micro level and is in line with the increasing efforts in the economics literature to assess the effectiveness of public policies effectively. Following this trend, the Directorate General for Regional and Urban Policy (DG-REGIO) produced the “Guidance Document on Monitoring and Evaluation – European Regional Development Fund and Cohesion Fund” (DG-REGIO, 2014). The document presents the key

concepts and terms of programming, monitoring and evaluation adjusted to practical application by regions. For instance, the document suggests the use of counterfactual impact evaluation that is a set of techniques that have the potential to provide a credible answer to whether an intervention works or not. For instance, DG-REGIO (2014) list difference-in-difference, discontinuity design, propensity score matching, instrumental variables and randomised controlled trials as tools to assess the impact of regional policies in the EU. Thus, following the trend in the literature, it is likely that DG-REGIO (2014) will promote more rigorous impact of regional policies in the EU in near future.

1.3.5. FURTHER REFORMS OF COHESION POLICY

Over time regional policy has been adapted to new conditions emerged in the enlarged European Union and the evaluation of the effectiveness of this policy has shown that new reforms are needed to achieve better results. The European Commission suggests the following:

Reinforcing strategic programming: This requires clear guidance at European level and a common strategic framework that would involve the Cohesion Fund, the European Regional Development Fund, the European Social Fund, the European Agricultural Fund for Rural Development and the Fisheries Fund. It also requires a development and investment contract involving all actors, the setting out of investment priorities, the allocation of national and the Union resources in the priority areas and establishing clearly the targets to achieve. Operational programs are needed to define the main management tools and turn the strategic documents into concrete investments.

Increasing thematic concentration: Member states and regions must concentrate the EU and national resources on a small number of priorities referred to specific challenges they face and according to the structural funds they receive.

Strengthening economic performance: The effectiveness of the cohesion policy largely depends on the economic environment in which it operates (favorable macro and microeconomic conditions, better institutions) therefore, it is necessary to strengthen the links between the cohesion policy and the economic governance of the Union. Institutional reforms, such as, reducing regulatory and administrative burdens, improving public services, are crucial for structural adjustments which foster growth, increase employment and reduce social exclusion. These reforms should be implemented at the national and regional levels.

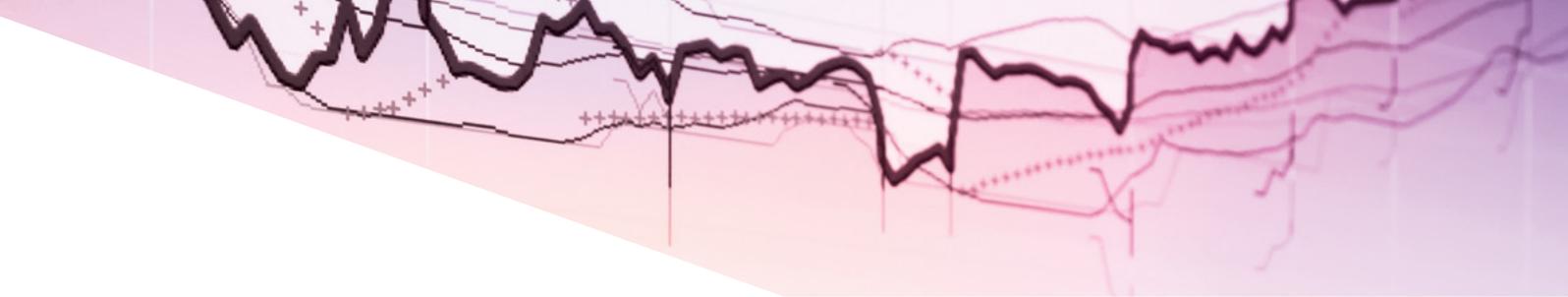
Improving evaluation, performance and results: Systems of impact evaluation with higher quality and better methods of monitoring are crucial for measuring the effectiveness of the cohesion policy. This can be done by an ex-ante setting of clear and measurable targets and outcome indicators. Indicators must be clearly interpretable, statistically confirmed and directly linked to policy targets. The tools and incentives for achieving objectives and targets must be monitored and evaluated during the programs implementation.

Supporting use of new financial instruments: New forms of financing investment must be moving away from the traditional grant-based financing system towards innovative ways of combining grants and loans and through a public-private partnership. It is needed a higher clarification and differentiation between rules governing grant-based financing and rules governing repayable forms of assistance.

Provide generic financial support to firms to co-finance target support projects (innovation, environmental investments, etc.). Extend both the scope and scale of financial instruments to encompass new activities, such as, sustainable urban transports, research and development, energy, local development, ICT and broadband.

Introducing territorial cohesion dimension: The Lisbon Treaty has added territorial cohesion to the goals of economic and social cohesion. Therefore it is important to include this dimension in the new programs, taking into consideration the role of cities, the territory, areas facing specific geographical and demographic problems and accordingly to develop macro-regional strategies. Higher growth rates and employment can be achieved bringing together various partners, such as, companies, universities, local authorities and research centers. Urban problems linked to environmental degradation or to social exclusion call for the involvement of all these partners developing an ambitious urban agenda. Programs could then be designed and implemented not only at national and regional levels but also at the level of groups of towns or of river or sea basins. Territorial cohesion also means to take into account urban-rural linkages that could allow to developing quality infrastructures and services, and considering problems of regions with socially marginalized communities. Further work is needed on new macro-regional strategies using the availability of resources. Regional programs can be co-financed by the cohesion policy and from national resources.

Reinforcing partnership: The effectiveness of regional policy in the EU requires a governance system that involves the Member States, the EU institutions, national, regional and local authorities. Close collaboration between public and private entities as well as socio-economic partners and



non-governmental organizations should also be maintained. The role of local development approaches under the cohesion policy should be reinforced by supporting active inclusion policies, innovation strategies, job creation policies, maritime policies, and promoting rural development or designing strategies to develop deprived areas.

In general terms, support should be differentiated between regions taking into account their level of development (measured by GDP per capita) and making a clear distinction between less and more developed regions.

The financial crisis and recession since 2008 made clear the important role of creativity and innovation having a distinct regional dimension. Convergence regions can obtain large benefits from foreign firms by embedding them into their economy. Strong links between foreign firms and local suppliers increase production efficiency, local employment and technological and knowledge transfers. Human capital qualifications through improvements in educational attainment and training will increase their capacity to absorb new ideas and practices increasing regional productivity and competitiveness. Appeals to leisure and business travelers by stimulating cultural and creative activities are important for regional development and can attract new residence and returning migration. Transition regions besides closing their development gap they still need to make progress in productivity, competitiveness, R&D, patents and human capital standards and improve their business environment. This implies to accelerate the transition from new ideas to new products, services or production processes.

1.4. CONCLUDING REMARKS

In this survey an attempt has been made to describe the Regional Policy in the EU and evaluate its importance for achieving the targets established over time through the signed Treaties. Regional Policy in the EU has been adapted and designed according to new regional asymmetries emerged as a result of successive enlargements and following the paths of higher economic and political integration. The main goal of Regional Policy in the EU is to reduce regional asymmetries across its member states by assisting less developed regions to improve their economic performance and converge towards the more advanced regions.

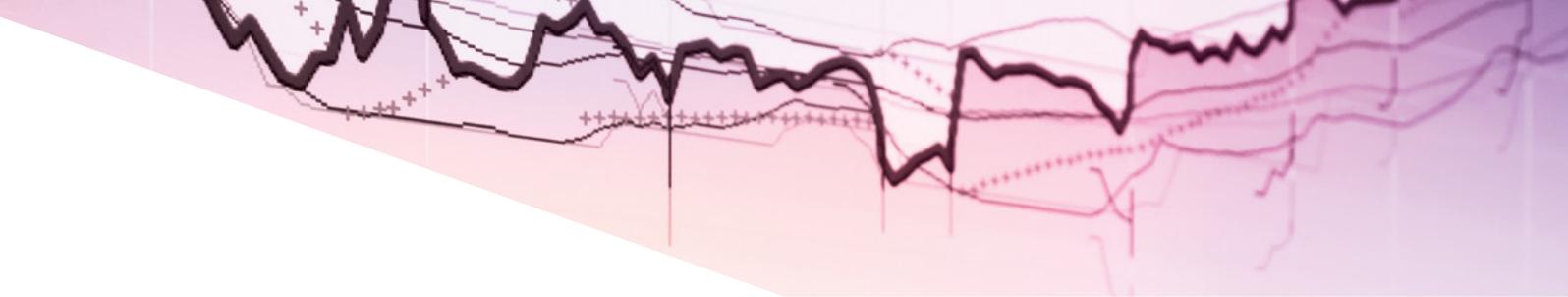
It is recognized that bigger in size integration and higher market and economic integration brings new opportunities to explore associated with higher economies to scale. However, this larger scale markets will be better exploited by the most dynamic and competitive economies (states or regions) and backward economies (specially the distant ones) will stay behind. More dynamic economies have better infrastructures, better human capital resources and higher performance in innovation activities. Therefore, a priori are in great advantage to succeed with a larger Europe and exploit better the new economic opportunities. A larger European Union (due to successive enlargements) with common macroeconomic policies (due to deeper integration) will have the winners and the losers, raising the need to compensate the losers through the winners.

Theoretically, it is recognized that the absolute convergence paradigm has failed to reduce regional asymmetries, which is based on the doctrine that in highly integrated markets with free movement of productive factors, poorer economies will grow faster

relatively to richer once, because of decreasing returns to scale and lower marginal productivity of capital stock. There is not such an automatic market mechanism that could lead to a reduction of regional disparities over time without any kind of intervention. On the contrary, advanced economies (countries or regions) will attract productive factors (capital and labor) as being better remunerated and form the so called agglomeration or cluster economies at the cost of the less developed regions. A cumulative causation process will take place with increasing returns to scale characteristics that will turn the most dynamic economies richer and the less developed economies poorer. This is in line with the endogenous growth approach and the new economic geography theory.

The incapability of free markets to solve the problem of regional disparities justifies the adoption of an active Regional Policy in the EU to tackle this problem. European Cohesion Programs and Structural Funds are taking care of the unequal regional development, assisting lagging economies. The allocation of structural funds has moved from the initial redistribution target (income support policies) to a strategy aiming at increasing the competitiveness of the regions by financing investments in infrastructures, human capital improvements and in innovation activities. Investing in these crucial areas is the sound way to help regions to grow faster and converge towards the more advanced ones. The EU regional policy has also moved from the initial country-level support to regional and local-economies support. This is the last regional policy reform explained in the Fifth Report on Economic, Social and Territorial Cohesion. Simplifying the Objectives targets, moving from annual to multi-annual (five year) programs and giving more attention to the environmental conditions are some of the new targeting reforms.

The assessment of the effectiveness of the regional policy in the EU shows that although regional asymmetries are still significant across the Union, the common view is that without the Cohesion Policy regional disparities should be even higher. Nevertheless, some findings should be viewed with caution as there is a significant effort in the DG-REGIO to promote more rigorous impact evaluation that might shed more lights on the results of Cohesion Policy. It is recognized that Cohesion Policy has short-term demand effects emerging from investments in infrastructures in the recipient regions that result in higher income and employment during the time of the program implementation. The long-term supply effects emerge from investments in human capital and innovation activities. The combination of both effects is the best strategy to help regions to increase their competitiveness and compete in the globalized world. The results from impact evaluations at micro level might also contribute to the understanding of the definition of the best strategy for the regional policy.



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2. THE EFFECTIVENESS OF REGIONAL POLICY ON THE CONVERGENCE PROCESS IN THE EU

The aim of this chapter is to provide a literature review on the effects of Regional Policy in the EU to achieve the main goal of reducing regional disparities across its member states. The majority of these studies on this topic deal with the so-called economic convergence phenomenon based on the theoretical concepts of absolute and conditional convergence. The theoretical background of these concepts and the model used to test for convergence are explained in Section 2.1 of this work. Section 2.2 explains the main factors of convergence that the empirical literature suggests as being crucial for achieving higher growth, and the mechanism explaining the linkages between them. Section 2.3 brings empirical evidence on the convergence experience among countries, among regions in the EU and among regions within the same country. Since the empirical evidence is mixed and not unanimous, we focus on studies that found convergence across regions supported by structural funds; studies that found periods of convergence and periods of divergence, and studies arguing that structural funds and in general regional policy was not effective enough to reduce regional asymmetries in the EU. The last section of this assessment concludes on the main findings of the effectiveness of regional policy to reduce economic disparities among the regions in the EU, highlighting some stylized facts.

2.1. CONCEPTS AND MODEL OF CONVERGENCE

The Treaty that established the European Community defines economic and social cohesion as one of the crucial goals of the Union. Cohesion can be achieved through the promotion of growth-enhancing policies able to reduce the disparities between the levels of development across the EU regions and Member States which are key targets of the European Cohesion Policy. In practical terms measuring and evaluating the achievements on Cohesion is closely related to the convergence issue that researchers are concerned with. Therefore, the promotion of convergence has become a major aspect in assessing the effectiveness of the European Cohesion Policy. As Monfort P. (2008) explains, measuring convergence presents some complexities due to several definitions of this phenomenon, that although coherent, they correspond to different concepts of convergence. Additionally, there is no convergence measure capable of capturing all relevant aspects of a convergence process, therefore, researchers must have a clear view of the type of convergence they use and its limitations when try to measure and evaluate convergence. The main concepts of convergence will be explained in the following sections of this work.

2.1.1. ABSOLUTE CONVERGENCE

The origin of the studies on economic convergence is found in the neoclassical growth theory and the Solow's (1956) growth model. According to this theory, factors of production face diminishing returns and technological progress is exogenous. The marginal productivity of capital is higher in regions with a lower capital/labour ratio. Capital flows to less developed economies where capital

stock and wages are lower thus taking advantage of higher profitability. Technology is a public good freely available to everyone, thus facilitating the technological diffusion process, with no additional costs for the less developed economies. Full mobility of reproducible factors as well as the homogeneity of preferences and of the savings (investment) rate are additional assumptions for growth.

Empirically, the convergence hypothesis is confirmed when the negative correlation between the growth of per capita income (or product per worker) and its initial level is fulfilled, and this is known as the absolute convergence approach. This kind of convergence (known also as beta-convergence⁴) refers to a process in which poor regions grow faster than the rich ones and therefore catch-up the others. In the long-term, all economies will grow at similar rates and converge to the same steady-state. Divergence is a short-term phenomenon, reflecting transitory adjustments to the steady-state level. The higher the distance from the steady-state the higher the speed of convergence is expected to be found. Trade is not considered as an impediment to growth since flexible relative prices solve the problem of trade imbalances and bring the economy back to equilibrium (Soukiazis E. and Micaela Antunes, 2011).

2.1.2. THE σ -CONVERGENCE CONCEPT

Another statistical measure of converge known in the literature is the so-called σ -convergence, which is used to determine the dispersion of per capita income over time for a sample of different

4. Sala-i-Martin(1994) attributed the name of σ -convergence to distinguish it from the β -convergence notion.

economies. The standard deviation or the coefficient of variation of regional GDP per head is normally used to measure σ -convergence, the latter given by the standard deviation over the sample mean. When the coefficient of variation is declining over time indicates that economies are converging as a result of lower dispersion of income and when it is increasing indicates an income divergence across economies. Sala-i-Martin (1994) argues that σ -convergence is a necessary but not a sufficient condition for β -convergence to take place.

As an example, Monfort P. (2008) presents results on σ -convergence for the NUTS2 regions⁵ of the EU-15 and EU-27 considering regional GDP per head over the period 1980-2005 and 1995-2005, respectively. He found that convergence between the EU-15 regions was stronger up to mid 90's but the process since then became stagnant. The coefficient of variation from 1980 to 1996 decreased from 0.33 to 0.28, while since 1996 has ranged between 0.28 and 0.29. On the other hand, disparities continued to decrease rapidly among the EU-27 regions, the coefficient of variation falling from 0.43 to 0.35 over the period 1995-2005.

However, β -convergence and σ -convergence are different concepts, provide different information and they are obtained by different processes, the former through a regression approach the latter through a statistical indicator.

2.1.3. CONDITIONAL CONVERGENCE

Over time, empirical evidence has not confirmed the neoclassical principle of absolute convergence. In fact, the deepening of the differences among

5. Nomenclature of Territorial Unit Statistics



the more and the less developed countries has been demonstrated in the literature. The existence of absolute convergence is limited to more homogeneous economies (countries and regions with similar structures). Economists have searched for alternatives to better understand the factors affecting economic growth and its trajectory.

Romer's (1986) work pointed out the failure of the neoclassical convergence hypothesis, when confronted with empirical evidence. Growth models with increasing returns to scale, coming mainly from human capital and technological progress, became an alternative to the neoclassical approach. Baumol (1986), Barro and Sala-i-Martin (1992) and Mankiw et al. (1992) assessed the existence of conditional convergence when differences on structural factors were taken into account. Islam (1995), Galor (1996) and Temple (1999) indicated the most proper empirical methodologies to test the convergence hypothesis. The theoretical growth models used by the majority of the cited authors were based on the aggregate production functions with physical capital, human capital and technology as the relevant control factors to explain income growth.

The endogenous growth theory stresses the importance of human capital for growth and advocates that human capital is the engine of growth and the factor responsible for increasing returns to scale characteristics in the long term analysis (e.g. Romer, 1986, Lucas, 1986). Later, with the development of the concept of conditional convergence, human capital became a key factor to growth process and the idea of local increasing returns to scale was accommodated in the neoclassical conditional convergence equation.

These models indicate that there is no any automatic tendency for a clear convergence in per capita

income among economies, unless differences in structures are controlled for. In the real world, economies do not show the structures required by the absolute convergence hypothesis, except when they become alike in terms of human capital, technological progress and innovation, among others. Different economies tend to converge to different steady-states, characterised by dissimilar economic structures, thus reflecting differences in the production functions.

Convergence is conditional to some structural factors with increasing returns to scale properties, such as human and physical capital accumulation, technological progress, and innovation, among others. Economies converge to different steady-states because of differences in economic structures. Convergence is not the rule, but rather the exception, occurring when the economies are able to develop activities with increasing returns to scale characteristics. Convergence is found after differences in the steady states across economies are controlled for.

2.1.4. THE CONVERGENCE MODEL

The convergence equation more often estimated in the empirical literature is of the Barro's type, assuming that human capital is partly endogenous with increasing returns properties in the long-term that compensate the diminishing returns of physical capital. The model has been adjusted by Mankiw et al. (1992) to include human capital and by Islam (1995) to be used with panel data, controlling for differences in the production function among different economies. According to these authors, the convergence equation is given by the following relation:

$$\begin{aligned} \ln y_i(t_2) - \ln y_i(t_1) &= \\ &= \theta \ln A_0 + gt - \theta \ln y_i(t_1) - \theta \frac{a}{1-a} \ln(n_{i,t} + g + \delta) + \theta \frac{a}{1-a} \ln(s_{i,t}) + \theta \frac{\beta}{1-\alpha} \ln(h_{i,t}) + \theta \frac{\gamma}{1-a} \ln(m_{i,t}) + v_{i,t} \end{aligned}$$

In this expression, y is per capita income (or per worker product), n the annual growth rate of population, g the growth of technology, δ the depreciation rate, s the savings (investment) rate, h human capital and m any other factor that can influence the convergence process (trade, health status, institutions, etc.). On the other hand, α , β and γ are growth elasticities with respect to physical capital, human capital and other additional factor, respectively. Finally, $\theta = (1 - e^{-\lambda T})$ with λ the speed of convergence, gt is a constant (technological progress is assumed to be the same for all economies) and A_0 reflects not only the technological level but also resource endowments, the legal system and institutions, among others, and thus it may differ across economies. The term $\theta \ln A_0$ is the time-invariant individual effect term reflecting the economy's specific effects and v_{it} is the error term that varies across countries and over time.

Estimating the above equation by panel data techniques is the best way to control for the specific effects among economies with different structures. More recent contributions also introduce a spatial dimension into the formulation of the convergence function to capture spatial autocorrelation and externality effects among regions which are stronger in neighboring areas. There is reason to believe that the omission of spatial effects from the analysis of beta-convergence is likely to produce biased results (see Baumont et al., 2003; Dall'Erba and Le Gallo, 2006). Especially working with regional data requires addressing the specific issue of spatial dependence. Introducing the so called spatial lags is the solution to account for the fact that the growth of one region also depends on the growth of surrounding regions. If spatial correlation is found to be relevant, indicates that externality effects are at work.

2.1.5. CONVERGENCE VERSUS DIVERGENCE THEORIES

The question whether economic integration will lead to real convergence is debatable. Convergence theory states that economic integration across regions, under the conditions of free movement of goods, services, capital and labor, by definition will foster convergence, even in the absence of policy measures, such as financed by Structural Funds. Economic integration will lead to identical production technologies in all regions and therefore identical returns to factor inputs (labor and capital).

Divergence theory stresses the importance of technological differences, differences in regional structures, the existence of transport costs and the importance of agglomeration effects and economic clusters. Divergence theory is linked to two main growth approaches: (i) the cumulative causation principle stating that more competitive regions will attract production resources increasing therefore the gap between poor and rich region; (ii) the economic geography approach addressing that economic development will benefit the formation of clusters in certain places (cities and regions) and generate long-run income divergence. Market integration,



scale economies, transport costs and home market effects combine to favor the concentration of economic activity in “core” regions in detriment to the “periphery”. These theories predict a heterogeneous economic development among regions within an integrated economic area (such as the EU) with significant differences in factor returns. Therefore, active policy intervention is needed to improve the capacities of the lagging regions to grow faster and converge with the leading regions.

Empirical evidence for the EU provides partial support for both theories. Looking at the period since 1980 (the start of structural funds policy), the evidence shows a clear tendency of per capita income convergence among the EU countries but less convergence is found at the regional level. This raises the question of whether regional policy (through structural funds) is effective in reducing regional disparities in the EU.

2.2. FACTORS OF CONVERGENCE

A huge range of factors has been tested in the literature as potential determinants of growth, affecting therefore the convergence process between economies. Economic and social factors, technical, political, institutional or even factors related to religion, location, market accessibility, quality of firms and entrepreneurship, crime, corruption, informal economy, climate among others, are included in the growth determinants list. However, a common consensus exists that beyond the physical capital and labor factor inputs, other determinants such as human capital, technology, innovation and others that could increase the human capital performance, like education,

training and health are essential for growth. These factors will be considered further, explaining the mechanism through which affect economic growth and contribute to the convergence process.

2.2.1. HUMAN CAPITAL AND TECHNOLOGY

The models of endogenous growth attribute a special role to human capital (Barro, 1991). The influence of this variable on growth was pointed out by authors like Lucas (1988), Mankiw et al. (1992) and Islam (1995), who developed theoretical models to incorporate human capital as an additional factor of growth. Human capital qualification contributes to increase the productivity of both human and physical capital and may either be acquired through schooling or learning-by-doing processes (Lucas, 1988; Romer, 1990). Since economies differ in their human capital endowments, it is relevant to analyse whether it is an appropriate factor to explain disparities across economies, concerning growth paths.

All the above authors explicitly suggested the inclusion of human capital in the production function as a way to control for the previously found high values of elasticity of output with respect to capital (in a broader sense) and to improve the fit of the growth regressions. The Solow’s model was considered to be consistent with international empirical evidence, if the importance of both physical and human capital was recognized. Furthermore, about 80 per cent of the international variation in per capita income was attributed to only three variables: the population growth rate and the rates of investment on both physical and human capital.

Barro (1991) observed that holding the flow of

investment on human capital constant, the negative relationship between economic growth and the initial level of per capita income (the convergence hypothesis) became more significant, and human capital showed to have a positive relationship with the growth of output. On the other hand, it was observed that whenever international mobility of capital and technology was allowed for, the tendency for poor countries to catch-up with rich ones was reinforced.

The technology's ability to grow indefinitely when compared to human capital is the reason why for some authors it is the accumulation of technological change and not of human capital that constitutes a key factor in explaining growth (Romer, 1986; 1990; Grossman and Helpman, 1991; Di Liberto, 2005). According to this approach, the human capital stock both raises the rate of technological innovations (in developed countries) and increases the ability to adopt and implement new technologies from abroad (in the developing world). Thus human capital is one of the dimensions of the social capability which may enhance a country to catch-up with the technological leader (Abramovitz, 1986). Sedgley (1998) pointed out the private good properties of technology, together with the lack of social capability from the part of the less-developed countries as causes for the existence of technology gaps.

In the same line, Romer (1990) stressed the role of human capital in the research sector. In fact, it is in the R&D sector that new products and ideas are conceived to promote growth and therefore, the greater the initial stock of human capital of a country, the faster it will grow.

The non-rival property of technology implies the existence of knowledge spillovers, increasing returns

and externalities. The non-excludability degree depends both on the kind of knowledge produced and on the mechanisms protecting property rights. For the growth theory, it is the concept of partial excludability that matters, being closely linked to property rights protection through mechanisms like the patent production. Profit incentives to the R&D sector are thus determinant for the growth rate (Grossman and Helpman, 1991).

Sedgley (1998) considered the patent, R&D activities and the number of scientists and engineers as measures of innovation. Evidence was found of a positive impact of the innovative activity (proxied by the number of patents) on growth across the US states. However, when the human capital stock at the beginning of the period was added to the regression it lacked statistical significance and thus the author concluded for the impossibility to distinguish the stock of knowledge from the stock of human capital.

However, with respect to technology, some form of decreasing returns in the R&D sector has to be accounted for, to understand why the increase in human capital and research efforts in most developed countries have not been reflected into accelerating growth rates (Di Liberto, 2005). Romer (1986) had already pointed out that the existence of diminishing returns in the production of knowledge was necessary to prevent consumption and utility from growing too rapidly.

2.2.2 TRADE OPENNESS AND TECHNOLOGY DIFFUSION

Empirical studies testing the hypothesis of conditional convergence, strangely, have not sufficiently explored the possibility that trade can be



important for growth or in some circumstances a conditioning factor to growth⁶. On the other hand, international trade is completely absent in studies of regional convergence within the same country⁷.

The role of international trade on growth has been widely discussed by economists, especially from the 1950s onwards, due to different performances observed in various industrialised countries. The influence of trade on growth can be explained through several channels: trade is responsible for technological and knowledge transfers among trading partners; trade is essential for exploiting economies to scale due to market size; trade allows for a better reallocation of resources towards the more productive sectors; trade enhances higher product specialisation according to the comparative advantages principle (Grossman and Helpman, 1991; Yannikaya, 2003). In fact, international trade is considered to be a privileged way of transmission of R&D spillovers, namely through the acquisition of intermediate products and capital equipment containing foreign technology and innovation activities. Therefore, free trade affects convergence not only through the price mechanism (Temple, 1999) but also because the trade of goods, incorporating sophisticated technology and new ideas, accelerates technological diffusion among economies (Tondl, 2001).

Trade openness is by itself an incentive for economies to get involved in innovative activities, thus favouring growth in the long-term. In this context, a link between trade openness, human capital and technological changes can be established. The

stock of human capital is more likely to embrace R&D activities than the non-specialized workforce. The higher innovation rate enabled by R&D activities is further stimulated by the existence of an international market where new products and services can be traded and technological diffusion promoted.

The analysis of the role of trade on growth is extremely relevant because while it enables technological spillovers that guide to convergence, it may also provoke divergence ought to specialization by the law of comparative advantages (Di Liberto, 2005). Despite the existence of technology transfers enabled by the human capital stock, not all countries are capable of adopting foreign technologies from abroad, due to barriers like financial constraints and trade impediments.

The role of international trade in the diffusion of technology has been emphasized in several studies of economic growth (Coe et al., 1997; Economidou et al., 2006), within a perspective of increasing returns and cumulative causation tendencies (Fingleton and McCombie, 1998). Those countries trading more intensively with foreign economies are more likely to acquire know-how and reach or even surpass per capita income levels of the more advanced trading partners.

Linked to this line of research regarding connections among trade, human capital and growth stands the subject of economic integration. Economic integration with free trade of both goods and ideas and knowledge spillovers results on higher growth rates of output, due to the enlargement of the market and the increase in efficiency in the R&D sector, whenever similar economies are considered. Romer (1990) had already pointed out the benefits of trade among similar economies, arguing that it

6. Antunes and Soukiazis (2012), consider the balance-of-payments constraint hypothesis and the degree of openness as conditioning factors to explain the convergence process between the early EU-15 countries.

7. Soukiazis E. and Antunes M. (2011b) test the importance of trade on regional growth in Portugal using the conditional convergence framework on the NUTS3 regional level (30 regions).

would promote a better reallocation of resources used in research, thus avoiding redundancy in the R&D sector.

Trade policy has been found to affect growth in the EU countries mostly through technology transfers (Henrekson et al., 1997). Moreover, the stronger the relations among countries from the same trade bloc, the better the conditions for the growth of its members (Economidou et al., 2006).

Ben-David (1993) attributed most of the convergence among the OECD countries after WW II to the removal of trade barriers in the EU countries. Additionally, convergence among the EU and EFTA members did not seem to follow a generalized European trend concerning income disparity reduction. Membership of both EU and OECD was found to increase a country's growth rate, despite the lower magnitude of the impact in the latter case (Henrekson et al., 1997). Also, the evolution of technology was a crucial mechanism for convergence in the OECD countries (Di Liberto, 2005).

2.2.3. HEALTH STATUS

Grossman (1972) was the first to consider explicitly that health can be seen as a capital good, since the production of health determines how much time is spent in labor work. Healthier individuals are less likely to be absent at work due to illness and so they are more productive. In this context, health status is an important part of human capital, directly linked with education, and it can be defined as an individual's health stock. Like physical capital, health capital depreciates over time but individuals can invest to improve their health conditions.

Assuming a broader notion of human capital in economic growth analysis implies the need to disentangle the relations between its components (education and health) and economic performance. Human capital (education and health) improvements enhance economic growth and economic growth itself contributes to increase the levels of human capital through improvements in education and the health sector. It is important to explain how improvements in the health status of the population have a positive impact on economic performance through different mechanisms. Howitt (2005) identifies five main channels:

Productive efficiency: Health, like education, is a conditioning factor of an individual's productivity and efficiency. Healthier workers have more physical and mental energy, being more creative and productive. Healthier workers have higher chances of receiving skill upgrading investment from the part of the firms they work. More educated individuals are the ones who have better jobs, with higher incomes and better work conditions and so they are likely to invest more on health (Bloom et al., 2004). Health also affects labor supply since health problems cause many times absenteeism at work but also "presenteeism", a relatively recent concept meaning those individuals that even feeling too ill still go to work, although being less productive.

Life expectancy: One important outcome of health status improvements is the raise of life expectancy, which has consequences on education and investment/saving decisions. It makes investment in education more attractive and at the same time it is an incentive to save more for retirement, since individuals expect to live longer. Therefore an increase of life expectancy should raise schooling qualifications and saving rates. An increase of life expectancy has also effects on the demographic



structure of the population. By reducing infant mortality, a higher life expectancy will be reflected on a raise of the proportion of working age population. However, in the long term it is expectable that a decrease in the fertility rate will have the opposite effect, so the final result will depend on the predominance of these two forces.

Learning capacity: At a microeconomic level many studies empirically support the idea that an improvement on health status and nutrition are responsible for better cognitive capacities and educational outcomes. In general it is expected that healthier people have higher learning capacity explained not only by showing less absenteeism at school or at work but also for being more capable to assimilate and accumulate more knowledge. So it is expectable that healthier children will have better education and will be more productive in the future.

Creativity: Health improvements induce better educational achievements, which are likely to have additional effects on the country's creativity and innovation activity. This idea is supported by Nelson and Phelps (1966) who showed that educational improvement speeds technological diffusion since educated individuals are likely to become good innovators and to be more flexible to technological changes. Innovation and technical progress are highly dependent on the educational level where health has an important role to play for achieving higher standards in these sectors. It is assumed that healthier workers are more able to have positive reactions to change, which is a determining factor for a successful change implementation. Healthier and more educated workers will be more receptive to technological change and innovation processes.

Inequality: Investment on human capital qualification is one important explaining factor of

wage differentials. Having this in mind, promoting health can be seen as a vehicle to reduce income inequalities, since health policies will affect more the less favored population. Considering that better health is related to better education achievements and labor productivity, it is expectable that a healthier individual with higher school enrolment will be more productive and will have more job opportunities to explore with higher wages. As Howitt (2005) notes, a reduction of income inequality will allow a higher proportion of individuals to finance their education and their health needs, being therefore more able to improve their economic situation. Since the link between health and income is reversal, a decrease of income inequality will cause a reduction on health inequality. Investing in the health sector is a way to reduce income inequalities, increase labor productivity and therefore growth.

Having all these linkages in mind it is important to notice that the health sector gains a growing share in the economy especially in the most developed countries. In fact, the health sector (including social services) is responsible for an increasing proportion on total employment in the OECD countries. The average employment share in this sector is close to 10% with the highest records registered in the Scandinavian countries (20% in Norway). The health sector is important not only for improving labor productivity and personal wellbeing but for opening new employment and business opportunities with substantial multiplier effects on economic growth.

2.2.4. PUBLIC INFRASTRUCTURE AND INSTITUTIONS

Public infrastructure can contribute to long-run growth by providing additional inputs to private sector and enhancing productivity (Reiner Martin, 2003). However, this result depends on whether public investment will have crowd-in or crowd-out effects on the public sector. The transfer of resources to the public sector could only be justified if the returns to public investment exceed those of the private sector. In this case public investment would be self-financing as it would lead to an expansion of output overcoming the financing costs of the public investment. Structural funds are important instruments to contribute in productive public investment providing infrastructures that increase regional competitiveness. Empirical evidence suggests that the benefits of public investment are greater in regions with a low level of infrastructure capital stock but as aggregate investment increases the benefits become lower and an increasing share of public investment might even have negative effects on aggregate investment. In Public infrastructures we can include institutional factors that can contribute to the agglomeration of economic activity, such as investment on education, innovation and R&D, venture capital financing and business support. Weak institutions may have negative influence on the provision of public goods and on the development of policies to improve human capital and innovation capacity or other potential sources of growth. Therefore, the quality of institutions will depend on the capacity of the region to develop or attract the human capital and other resources needed to achieve high levels of developments.

2.2.5. SPATIAL DEPENDENCE

In recent years researchers have been taken a different view on the cohesion policy and its effectiveness by giving a particular attention to the geographical dynamics of economic development (Farole T., Rodrigues-Pose A., and Storper M., 2011). This is linked to the new theory of economic geography giving importance to the spatial interdependence between regions that is responsible for the formation of agglomerated economies (clusters) that benefit from externalities due to the reduction of transport and communication costs and higher technology diffusion as well as knowledge spillovers. From the empirical point of view the convergence equation is estimated by incorporating the spatial autocorrelation matrix and introducing heterogeneity across regions. Recently, Resende G. M., and Cravo T. A., (2014) have shown that the choice of the spatial scale matters in the analysis of the convergence process and that can alter the empirical results when different spatial scales are considered.

All the above shows that Regional Policies that allocate financial resources to improve infrastructures, human capital qualifications (through better education and health), stimulate technology activities and expand innovation all of which contribute to enhance competitiveness, are the most effective policies if the main goal is to help backward economies (countries or regions) to reduce their distance from the most advanced economies and achieve a sustainable development path.

2.3. EMPIRICAL EVIDENCE

In this section we present empirical evidence on the convergence issue identifying the main factors responsible for achieving such a result. We provide evidence that test the convergence hypothesis among countries, among regions of the EU countries (which is the focus of our analysis) and among regions within the same country. This evidence is important in terms of Regional Policy orientation and effectiveness.

2.3.1. CONVERGENCE ACROSS COUNTRIES

Implementing a dynamic panel data approach for 77 countries over the period 1980-2000, Soukiazis and Cravo (2008) divide the whole sample in three subgroups according to the country's per capita income level. The study uses new proxies for human capital, such as, publication ratio, patents ratio and the patents/articles ratio which all reflect the efficiency of the scientific work, in contrast to the quantitative measures of human capital usually used in the growth literature (school enrolment rates). The whole analysis shows that:

Convergence is conditional rather than absolute revealing that the initial income level is not a potential factor alone to explain the convergence process. Structural factors must be considered too, especially related to human capital. Convergence is close to the 2% stylized rate found by Barro (1991) except for the OECD group that is less than 1%.

The different proxies of human capital used to differentiate countries are shown to be appropriate in explaining the growth pattern among economies. Generally, any form of human capital contributes

favourably to increase the standards of living and approximate the countries income levels. Conditional convergence is higher (than the absolute) when human capital is accounted for in the convergence equation.

Different levels of human capital have different growth effects depending of the countries stage of development. The evidence shows that higher levels of human capital expressed by the patent ratio or patent/publication ratio explain better the convergence process for the set of the more advanced countries, while standard levels of education expressed by the average years of school attainment control better the steady states of the less developed countries (i.e. the Latin American countries). The highest rate of convergence found in the Latin American group (2.37%) is when the basic level of schooling is used as the controlling factor. On the other hand, in the sample of the richer group (18 countries) only the higher levels of human capital (patent and patent/ publication ratios) have a significant impact on growth. Convergence increases from 0.43% to 0.76% and farther to 0.86% in the rich OECD countries when a passage is made from lower levels of human capital (average years of schooling), to higher levels (publications and patent ratios), successively.

In general, their evidence suggests that improvements in human capital must be gradual, investing primarily in basic school structures before going to develop higher levels of education and activities related to research and innovation.

Recognizing the importance of trade Soukiazis E. and Antunes M. (2010) estimate an augmented neoclassical growth model adding different proxies of human capital and foreign trade as conditioning factors to growth and convergence.

They implemented the GMM estimation approach to a dynamic panel data growth model where all regressors were assumed endogenous. The whole sample consisted of 78 countries for the period 1980-2000, making special reference to the sets of European, EMU and OECD countries.

Concerning the whole sample (78 countries), they obtained evidence of convergence (3% annual rate) only when the net foreign trade was combined with the average years of schooling. The net foreign balance can be taken as an indicator of trade competitiveness, affecting growth significantly. When countries were divided according to their income level, only for high-income countries (27) was it possible to achieve plausible results. Once more, it was the net foreign balance combined with average years of schooling that proved to be relevant in explaining the growth performance of these countries, showing a higher annual convergence rate at about 7.9 per cent.

In the set of middle-income countries, international trade proxies were more important than human capital for the explanation of annual growth in per capita income, whereas in the low-income group both human capital and net foreign trade were relevant factors for growth, the latter being more significant. International competitiveness seems to be a crucial determinant for growth and convergence in the developing and less-developed countries.

The set of 20 European countries was considered as a special case to test whether geographical characteristics matter for growth. The idea was that countries of the same spatial block trade more intensively, enjoy special trade agreements, benefit from higher factor mobility and more intensive interchange of knowledge and technology, all of which are thought to foster growth and convergence. In fact, the growth regressions of the set of European

countries showed that both the patents (measure of innovation) and the patents/ articles ratio (scientific production), together with the openness variable were the most relevant conditioning factors to growth. The patents ratio (as well as the patents/ articles ratio), is the type of human capital reflecting innovation activities, responsible for the production of new products and ideas, turning the economies more competitive. Knowledge and technology diffusion are highly related and the degree of openness makes the transfer of knowledge and technology developments easier. The regressions showed that due to higher levels of human capital and the degree of openness, convergence across the European countries is achieved at higher rates, between 8 and 10 per cent per annum.

In the same study Soukiazis E. and Antunes M. (2010) considered as a special group the set of 11 EMU countries characterized by a high degree of economic integration, implementing policies with the aim to adopt a single currency. The idea was to examine whether balance of payments problems are important even for countries that aim to adopt a fixed exchange rate regime. The regressions showed that in fact net foreign balance is an important determinant of growth for these countries and it was successfully combined with most of the human capital variables, either with average years of schooling or with higher levels of human capital expressed by scientific production (articles ratio) or by innovation activities (patents ratio). When foreign trade performance and human capital qualifications were controlled for in the growth equations convergence between the EMU countries runs at a higher rate, between 13 and 17 per cent per annum. This high rate of convergence can be explained by the effort made to meet the Maastricht criteria established in 1992 to achieve the monetary union in 1999.



The inclusion of interaction terms in the growth regressions apparently reflected the existence of combined effects from human capital and international trade on growth. In fact, only for Europe and OECD was it possible to compute reasonable results suggesting that the more open an economy is, the more effective is the impact of human capital on growth. This can be taken as evidence of knowledge-technology diffusion and it is in line with the idea that technology and knowledge are transferred through trade. Likewise, the more human capital an economy accumulates, the higher its contribution to a positive impact of openness on growth, through improvements in competitiveness. A country lying behind the cut-off points either of human capital or openness will face adverse impacts on growth. Therefore, openness seems to exert a positive impact on growth, amplified by the way it interacts with human capital.

In general, in the above study the patents and the patents/articles ratios, indicators of the efficiency of the educational system, have shown to be proper proxies for human capital, when combined either with the openness variable or the net foreign trade. Also the average years of schooling appeared to be relevant in some reported results, though not always related to countries with lower level of development. Net foreign trade was shown to be an important determinant for growth, suggesting that trade balance problems can be harmful for growth. The combination of human capital and foreign trade indicators can be assumed as important conditioning factors to growth and policies should be designed to foster competitiveness through improvements in education and innovation activities.

In a later study, Antunes M., and Soukiazis E. (2012) criticize that the neoclassical theory of growth does not attribute a special role to foreign trade, and most

importantly, that the supply-orientated approach (including both the neoclassical and endogenous growth perspectives) does not consider that foreign trade imbalances can constrain domestic demand and retard growth. According to these theories, price flexibility brings the economy back to equilibrium whenever a shock occurs. Although the endogenous growth theory recognizes the importance of trade especially through the process of technological transfer and diffusion, it still remains a supply-orientated approach not giving an important consideration to the external demand as a possible constraint to growth. On the other hand, the demand-orientated approach, through the balance-of-payments constraint hypothesis, highlights the importance of external demand as the key factor for growth and the foreign trade imbalances as serious impediments to growth.

In the above study the authors try to reconcile these two views by introducing into the endogenous growth model factors related to foreign trade - and explicitly the balance-of-payments constraint hypothesis – to test their relevance. A more complete model of growth is estimated by using different proxies of human capital and foreign trade to differentiate more properly the EU countries. Interaction terms have also been used to detect important links between human capital and foreign trade, and also between (non-price) competitiveness and trade intensification.

Their empirical analysis estimates growth equations by using a panel data approach for a set of the early European Union members, over the period 1980-2004. Conditional convergence is found among the EU countries, being reinforced when human capital, foreign trade and (non-price) competitiveness are controlled for in the growth model. They also show that human capital (especially higher levels)

and foreign trade (mostly through openness) or the interactions between them are important determinants to growth. Significant links are detected between human capital, trade and economic growth supporting the idea of knowledge and technology diffusion. The balance-of-payments constraint hypothesis has also been highlighted in the empirical approach through the interaction between openness and competitiveness⁸. Whenever there are restrictions to growth, the constraining element may either be foreign trade, human capital, or both.

Focusing on the importance of health status, Poças Ana and Soukiazis Elias (2010) analyze the impact of health conditions on economic growth and convergence, using a growth regression framework for a sample of 22 OECD countries. Along with infant mortality rate or life expectancy they also considered mortality rates caused by chronic diseases or variables that measure human resources and the activity of health care systems. These proxies can differentiate more properly health conditions of the developed countries and so they can be more relevant in measuring their impact on economic growth and convergence. The methodology used was based on panel data dynamic analysis and estimations were made for the period 1980-2004 using GMM methods. Their findings show that the proxies used for chronic diseases, health care activity and resources devoted to health care are pertinent in explaining economic growth and convergence between this set of countries.

More explicitly, cerebrovascular mortality rates, average length of stay, number of physicians and acute care beds are the most significant health factors affecting the standards of living of these developed countries. Other health conditions, such as infant mortality or life expectancy, have their expected impact on income, but at a lower level of statistical significance. As a policy implication they suggest that investment in preventing and controlling chronic diseases are of extreme importance. It is also important the implementation of educational policies able to influence lifestyles and contribute to more conscious risk behavior.

The results of the empirical evidence of convergence among countries are summarized in Table 2.1.

Table 2.1. Convergence among countries.

Authors	Sample	Period	Methodology	Results
Soukiazis and Cravo (2008)	77 countries	1980-2000	Convergence model applied to dynamic panel data	Different levels of human capital have different growth effects depending of the countries stage of development
Soukiazis E. and Antunes M. (2010)	78 countries (European, EMU and OECD)	1980-2000	GMM estimations applied to dynamic panel growth model	Evidence of 3% convergence rate. Trade, openness and schooling are important factors of convergence

8. The growth equation considers as foreign trade variables the degree of openness and the net foreign balance, to account for the impact of international trade on growth. The income-elasticity ratio with respect to exports and imports is also included in the regression to highlight the balance-of-payments constraint hypothesis.

Antunes M. and Soukiazis E. (2012)	15 European Union early members	1980-2004	Dynamic panel growth model, GMM estimations	Significant links are detected between high levels of human capital , trade and growth supporting the idea of knowledge and technology diffusion
Poças Ana and Soukiazis E. (2010)	22 OECD countries	1980-2004	Dynamic panel growth model, GMM estimations	Health conditions(health care, human resources to health) are important factors for growth and convergence among countries

2.3.2. CONVERGENCE AMONG REGIONS IN THE EU

Investigating the impact of European structural funds on the economic growth and convergence is a wide and challenging research topic. Empirical evidence has provided mixed and in some cases contradictory results. While some authors do find evidence of a positive impact of structural funds on economic growth, others find weak or even no impact at all. There are many reasons for these mixed results, among others, the low quality of structural funds data at a regional base, different periods of time considered, and different methodological techniques applied to measure the impact of structural funds on regional growth. The choice of the time period of investigation and the choice of the sample of regions are pre-determined by the availability of suitable data.

Several studies have been carried out at the European level to analyse the convergence phenomenon among regions, using different approaches, samples and time periods. In an early study by Cappelen et al. (1999) a comparison was made between the behaviour of EU9 and EU12 and the conclusion was that the convergence process in per capita income among the European regions had slowed down over the last years, despite the transfers of Structural Funds to the poorest regions. Meliciani and Peracchi (2006) considered the existence of spatial correlation and heterogeneity among regions. They used a set of 95 European regions during the period 1980-2000 and observed a convergence rate lower than the 2% usually found, and in some cases close to zero. In a more recent study, Battisti and Di Vaio (2008) analysed the EU15 and EU25 regions for the period 1980-2002 and concluded that only some of the regions exhibited a significant convergence tendency, while the majority displayed slow convergence and in some cases there was no convergence. In a study for Central and Eastern Europe, Herz and Vogel (2003) found a reduction in regional disparities during the first half of the 1990s and stability in the following years.

The rest of this section will consider specific studies that analyze the convergence issue between regions in the EU and the contribution of structural policies to reduce regional disparities.

Using cross-sectional and panel data for the whole set of European NUTS2 regions over the period 1989-99, Rodriguez-Pose A, Fratesi U., (2004) analyze the extent to which the allocation of structural funds across four development axes (infrastructure, agriculture and rural support, business support and human capital) may affect the capacity of structural policies to reduce the gap between the core and periphery in the EU space.

They found little or no evidence of greater economic cohesion and convergence across regions in the EU. They attribute this disappointing result on the fact that the process of economic integration across Europe is favoring the concentration of economic activity in the core regions of Europe, by fostering the formation of agglomeration economies in the core and leading to the concentration of high value added scale intensive activities in few regions. On the contrary, the periphery specializes in low value-added activities and non-market-orientated services. They point out two main failures of the regional policy in the EU: the lack of upward mobility of assisted regions and the failure of delivering greater economic and social cohesion across regions. Their analysis is concentrated on the impact of the Structural Funds allocated to Objective 1 regions, which represent more than two-thirds of the total funds. They found that despite the concentration of structural funds on infrastructure, and to a lesser extent, on business support, the returns to commitments on these areas were not significant. They argue that supports to agriculture have short-term positive effects on growth, but these vanish quickly. The investment in agricultural support and rural restructuring has a profile close to an income support strategy than to a sustainable development policy. Only investment in education and human capital has medium-term positive and significant returns. The connection between the share of funds invested on local human capital endowment and economic performance tends to be positive and significant, with the association being stable over time.

Mari Penalver (2007) found that Structural funds have positively affected the growth process of Objective 1 regions in the EU, but their impact was stronger during the first programming period (1989-1993) than the second (1994-2000). The

same conclusion is derived with respect to the δ -convergence process and the catching-up effects. Both phenomena were very significant in the first programming period but almost null in the second period. The author considered a composite of 41 Objective 1 European regions at the NUTS2 level during the two programming period running from 1989 to 2000. The theoretical model is a structural hybrid model where the rate of technology is partially endogenous, explained by two factors: (i) a catch-up effect (an exogenous component) where backward economies can increase their level of technology faster than the more advanced economies since it is easier to copy the existing technology than to invent new ones, (ii) an endogenous component coming from government expenses in activities that enhance total factor productivity (structural funds invested on transports, communications, energy, R&D, education, health, social infrastructure, etc). The econometric analysis uses panel data estimation techniques in a dynamic form of the convergence equation based on the endogenous growth theory in line with Barro and Sala-i-Martin (1991) empirical work. As a policy recommendation the author suggests that regions should restructure, modernize, and facilitate continuous knowledge-based innovations to cope with the increasing globalization challenges. Many less developed regions have a high employment share in traditional sectors where competition from emerging Asian countries is high. In these regions competition based on cost factors is not viable, therefore they need to modernize and diversify their economic structure producing high value-added products by creating conditions to develop businesses adopting innovative processes, to cooperate with other enterprises and research centers and internationalize their economies.

Considering a sample of 163 regions of the EU over the period 1981-1996, Ramajo, J., et

al. (2008) estimate the convergence equation using spatial econometric techniques. Their main purpose is to assess whether the cohesion policy in the EU contributes significantly to the process of convergence of the so-called cohesion countries (Ireland, Greece, Spain and Portugal). In line with the known division of the core and the periphery groups of regions in the EU, they provide evidence supporting the existence of two spatial convergence clubs, formed by regions belonging to the Cohesion and Non-Cohesion countries. They use an estimation approach that takes into account both, the spatial heterogeneity between regions and spatial autocorrelation. Their work shows clear evidence of separate spatial convergence clubs among the EU regions and that geographic localization and proximity play a key role in explaining the growth path of the involved regions. They found that regions of the cohesion countries converge with a faster rate in comparison with the rest of the regions of the EU, 5.3% versus 3.3%. Significant geographic spillovers also found through the endogenous spatial lag variable and the spatial cross-regressive lags of exogenous variables. As a result, EU Non-Cohesion regions benefit from neighboring Cohesion regions due to the structural funds received by the later. Regarding self-initial conditions their results shows that a high dependence on agriculture has a negative impact in both the Cohesion and Non-Cohesion regions, mainly due to low technological and market opportunities. On the other hand a high employment rate implies a positive influence on the convergence of the region towards its own stationary state. Their analysis provides support for policies designed to promote regional growth in the less developed regions belonging to the Cohesion club.

Dallérba, S. and Le Gallo, J. (2008), evaluate the impact of structural funds on the convergence

process among 145 European regions over the period 1989-1999. They questioned the efficiency of structural funds because are mainly devoted to assist less developed regions but regional inequalities persist in Europe and are higher among regions. They observe that structural funds are mostly devoted to finance infrastructures (mainly in transportation) but their impact on regional development is dubious. They take into account the presence of spillover effects that the spatial allocation of funds implies, by using spatial econometric techniques to capture spatial dependency. Their evidence shows that a significant regional convergence takes place (faster in the peripheral regions) but the structural funds have no significant impact on this convergence. In particular they found that the extent of the impact of structural funds on regional growth was not substantial in some Greek and Portuguese regions, which calls for the need to reallocate structural funds in a more efficient way and towards a growth enhancing activities. Simulation experiments show that investments targeted to the peripheral regions have no spillover effects to their neighbor's but they detect the presence of a growth diffusion process only in the core more developed regions. Core regions are more connected with each other, through more intensive trade and transport network than the peripheral regions. They conclude that the small extent of spillover effects in peripheral regions should be the explanation of their backwardness suggesting that regional policy in the EU needs to be reconsidered taking into account the role of interregional linkages or focusing on the factors promoting externalities when defining regional development strategies.

Esposti R. and Bussoletti S. (2008) estimate a dynamic panel model using data for 206 EU-15 regions over the period 1989-2000. They investigate the impact of Objective 1 structural

funds expenditure on the convergence of the EU regions by using an augmented convergence econometric model. They argue that structural funds must be modeled in the convergence model in a way to affect the investment ratio, given that they are mostly investments (on infrastructure, human capital and R&D), and increase therefore the capital stock. According to their findings, growth and convergence is influenced by structural funds, which affects the regional initial investment rate by interacting with other regional structural variables. They found that the convergence rate among the EU-15 regions ranges between 1.9 and 4.9%, and a positive impact of structural funds over the whole EU space, although its statistical significance and magnitude varies across the model specification used. The impact of the Objective 1 policy on growth is limited and become negligible or even negative in some specific cases. When regions are grouped by country, a negative effect is observed for German, Greek and Spanish Objective 1 regions, while for France the Objective 1 treatment has the highest impact on regional growth. Other conditioning variables such as human capital (share of tertiary level students on total population), regional transport infrastructure endowment (transport accessibility and connectivity), and R&D expenditures (private and public) have their expected positive impact on regional growth.

Mohl Philipp and Tobias Hagen (2009), analyze the growth effects of EU structural funds using panel data of 124 NUTS1/NUTS2 western European regions over the time period 1995-2005. They used more precise measures of structural funds payments by distinguishing Objective 1, 2, and 3 payments and implemented spatial panel econometric techniques controlling therefore, for heteroskedasticity, serial and spatial correlation as well as for endogeneity. They found no clear cut results for the total sum of

Objectives 1, 2 and 3, but the Objective 1 payments (the largest share of total structural funds) were the most significant with positive impact on regional growth. More specifically, they found that a one percent increase of Objective 1 payments leads to an increase of the GDP per capita by approximately 0.5%. On the other hand, the growth impact does not occur immediately but with a time lag of up to four years.

Following the recent literature that tries to attribute causal effects of policies in a more strict manner, Becker at al. (2010) compile data on 285 NUTS2 and 1213 NUTS3 regions in Europe for three programming periods (1989-1993), (1994-1999) and (2000-2006) to assess the effectiveness of transfers through the EU's Structural Funds Program on economic growth and employment. Using regression discontinuity design, they identify positive causal effects of Objective 1 treatment (regions whose per capita income is lower than 75% of the EU's average) on growth of per capita income in PPP terms. More specifically, on average, Objective 1 status raises real GDP per capita growth by 1.6% within the same programming period. However, they did not find significant effects on employment growth during the period in which transfers are allocated. The reason could be that job creation takes longer than the duration of a programming period which ranges from five to seven years. The growth effect on income is associated with a stimulus on the volume and structure of investment (e.g. infrastructure) and eventually with productivity gains but much less with the creation of new jobs.

In another study that focuses on the identification of causal effects on regional policy, Becker at al. (2012) use data at the NUTS3 level from the last two EU budgetary periods (1994-1999 and 2000-2006) and generalized propensity score estimation to

analyze if economic growth in the target regions was achieved with the funds provided. Furthermore, they analysed whether more transfers generated stronger growth effects. The results show that EU transfers enable faster growth in the recipient regions but in 36% of the recipient regions the transfer intensity exceeds the aggregate efficiency maximizing level, going beyond the optimal effect of the policy.

Accenturo and de Blasio (2012) used propensity score matching together with difference-in-difference estimator to assess the effectiveness of regional programs in Italian regions classified as underdeveloped areas as defined by the EU criteria for Structural Funds. The results indicate that the program has been largely ineffective. Studies that focuses on causal effects of regional policies are still limited but are likely to be promoted by DG-REGIO (2014), which is a guideline on monitoring and evaluation of regional policy in the EU. This type of studies provide important information to design effective regional policies.

Recently, Resende G. M., and Cravo T. A., (2014) make an important point, that the choice of the spatial scale is important when convergence is measured and that the result depends on the spatial scale used. They investigate the measurement issue that might cause variability in the EU-15 economic growth estimates

between 2000 and 2008 as a result of different spatial scales used to measure convergence between the NUTS1 (74 regions), NUTS2 (213 regions) and NUTS3 (1,087 regions) geographical units. Taking into account the spatial scale issue is a way to reduce the so-called aggregation bias when measuring region convergence. They show that their results for NUTS1 and 2 do not support the hypothesis of δ -convergence when country dummies are used in the estimation OLS approach. However, δ -convergence is found at NUTS3 regional level when country specific characteristics are introduced in the estimated equations, suggesting that convergence occurs within countries at finer spatial scales (NUTS3) rather than between countries. They also found significant spatial effects at NUTS3 regional level but at lower aggregation level such as NUTS1 and 2 levels. As policy recommendation they suggest that regional policies must take into account the results based on various spatial scales and not to only one geographical scale if the scope is to provide better information to policy decision makers.

The results of the empirical evidence of convergence among regions are summarized in Table 2.2.

Table 2.2. Convergence among regions

Authors	Sample	Period	Methodology	Results
Cappelen A, Fagerberg J. and Verspagen B. (1999)	EU9 and EU12	1980-1998	Convergence model panel data	Structural Funds didn't help to the convergence process in per capita income over the last years of analysis
Meliciani and Peracchi (2006)	95 European Regions	1980-2000	Panel data with special effects	Convergence rate lower than the 2% standard rate and in some cases close to zero
Battisti and Di Vaio (2008)	EU15 and EU25	1980-2002	Panel data convergence model	Only some regions exhibited significant convergence, the majority displayed slow convergence
Rodrigues-Pose A. and Fratesi U. (2004)	European Regions at NUTS2 level	1989-1999	Cross-sectional and panel data convergence models	They found little or no evidence of economic cohesion and convergence. They found evidence of agglomeration economies in the core regions of Europe
Mari Penalver (2007)	Objective 1 NUTS2 regions in the EU	1989-2000	Structural hybrid δ -convergence model with panel data	Stronger impact of structural funds on growth in the first programming period (1989-1993) than in the second (1994-2000). Less developed regions must specialize in high value-added products in order to converge
Ramajo, J., Márquez, M., Hewings, G., and Salinas, M. (2008)	163 regions of the EU	1981-1996	Convergence model with spatial correlation effects	Evidence of spatial convergence clubs, proximity plays an important role. Regions of the cohesion countries converge at a higher rate.
Dall'èbra S. and Le Gallo J. (2008)	145 European regions	1989-1999	Convergence model with spatial correlation effects	Significant convergence takes place but structural funds have not significant impact. Regional policies must take into account interregional linkages focusing on the factors promoting externalities
Esposti r. and Bussoletti S. (2008)	206 EU15 regions	1989-2000	Dynamic panel growth models	Structural funds must affect the investment ratio. They found a convergence rate between 1.9 and 4.9% and a positive impact of structural funds on regional growth.
Mohl P. and Tobias Hagen (2009)	124 NUTS1/NUTS2 western European regions	1995-2005	Growth model with panel data and serial and spatial correlations	The Objective 1 payments of structural funds have the most significant positive impact on regional growth. The growth impacts occur with a time lag up to four years.
Becker Sascha, Egger Peter, Maximilian von and Ehrlich (2010)	285 NUTS2 and 1213 NUTS3 European regions	1989-2006	Regression discontinuity	Objective 1 structural funds raise real GDP per capita growth by 1.6% within the same programming period. However the impact on employment is not significant.
Becker Sascha, Egger Peter, Maximilian von and Ehrlich (2012)	2280 NUTS3	1994-1999 and 2000-2006	Generalised propensity score matching	Focuses on the estimation of the response of average annual GDP per-capita growth to changes in the intensity of regional transfers provided by the European Commission and suggests that after an optimal level of resources the effectiveness of regional policy reduces.
Accenturo and de Blasio (2012)	435 treated, 1812 eligible non-treated and 896 non-eligible municipalities.	1991, 1996, 2001	Propensity score matching and difference-in-difference	No impact of regional support on regional economic performance.
Resende G. and Cravo T. (2014)	74 NUTS1, 213 NUTS2 and 1087 NUTS3 regions	2000-2008	Convergence model with panel data and spatial correlation effects	The Convergence result depends on the spatial scale used. Convergence is found at a finer spatial scale at NUTS3 level

2.3.3. CONVERGENCE AMONG REGIONS WITHIN A COUNTRY

Two special countries will be considered in this section, Portugal which is one of the so-called cohesion countries in the UE and Brazil as a Federal country of different States with peculiar characteristics. The role of regional policy is crucial to reduce regional disparities in both cases.

PORTUGAL

Antunes and Soukiazis (2006) showed that Structural Funds (European Regional Development Fund) received from the EU had contributed to a higher convergence of the Portuguese NUTS3 regions (30 regions). They explain the convergence process among the Portuguese regions by dividing vertically the country in two main areas the Littoral (the richer) and the Interior (the poorer). The role of structural funds in improving living standards and affecting the speed of convergence has been examined from the perspective of the conditional convergence using structural funds as a conditioning factor. The empirical analysis provides some interesting remarks which can be summarized as follows:

Structural funds increase the speed of convergence in per capita income as concern the whole set of regions. Structural funds contributed positively to the growth of per capita income but the marginal impact is not substantial. Therefore structural funds are used in a less productive manner, mostly orientated for improvements in infrastructure networks or used as direct income support (income redistribution policy).

Regional convergence in per capita income is slightly higher between the regions of the Interior

area revealing that these regions become more homogeneous over time and they converge to a different steady-state than the Littoral area. Regions belonging to the Littoral area grow faster in terms of per capita income and these are the regions that mostly benefit from structural funds. Therefore, the club convergence hypothesis is confirmed in Portugal with distinct geographical characteristics, the Littoral costal area and the Interior in-country zone with less accessibility facilities.

The distribution of structural funds is irrational in Portugal, benefiting more the more developed regions of the Littoral zone than the less developed regions of the Interior zone. This happens because the allocation of structural funds is based in the co-funding principle. Accordingly, the Littoral regions as being the most developed are more able to absorb the available financial resources and use them in a more efficient way. In the long run this tendency might increase further regional asymmetries in Portugal.

In another stream of research, Proença S., and Soukiazis E. (2005) and Soukiazis E., and Proença S. (2008) provide empirical evidence showing that tourism is a factor of regional convergence in Portugal. The panel data estimation approach gives evidence of the positive impact of tourism (through the accommodation capacity) on the growth of per capita income among the 30 NUTS3 Portuguese regions over the period 1993-2001, and speeds the convergence rate. More specifically, a 1% increase in accommodation capacity in the tourism sector induces 0.01% increase in per capita income in the Portuguese regions. When the accommodation capacity variable is introduced into the convergence equation, the annual rate of convergence in per capita income increases from 3.67% to 5.73% and the time to eliminate half of

the difference in per capita income reduces from 19 to 12 years. Another interesting result is that substantial economies to scale are detected in the tourism sector which enhances growth in the touristic areas. Therefore tourism can be considered as a factor that contributes to regional growth in Portugal if the supply characteristics of this sector are improved. It is known that large part of structural funds is invested in this sector benefiting more the coastal Littoral geographical area.

In a different study, Soukiazis E. and Antunes M. (2011) argue that foreign trade is as important for regional growth in Portugal as for the whole country, not sharing the argument that capital flows from the central government solve the problem of regional trade imbalances. They estimate growth equations that take into account foreign trade measures (along with human capital and sectoral employment shares) and verified their statistical relevance on regional growth and convergence. They also show that the Portuguese dichotomy between Littoral (16 coastal regions) and Interior (14 inland regions) is important for understanding regional asymmetries. Regions of the Littoral have generally higher standards of living, are more open to trade and more competitive in international markets. Although regions of the Littoral area show higher educational standards, the difference comparatively to the Interior is not substantial. They also stress that structural problem in Portugal, associated with the deindustrialisation tendency can partly explain the low growth rates in Portugal. It is shown that human resources are transferred from the primary and secondary sectors to services, were economies to scale and labour skills are relatively poorer and non-tradable goods are produced with high import content.

The empirical analysis based on the GMM regressions of the conditional convergence model provides

interesting insights for the sample of the 30 NUTS3 regions over the period 1996-2005. Conditional convergence is found and population growth plays an insignificant role in regional growth, whereas the employment share in the secondary sector is shown to be more important for growth relatively to employment shares in the two other sectors. This result suggests that policies have to be undertaken to reverse the deindustrialisation tendency in Portugal by transferring human resources to more productive activities found in the manufacturing and the industrial sectors. Another important finding is the confirmation that educational standards are important for regional growth and this is in line with the endogenous growth theory asserting that human capital is the engine of growth.

In this chapter, the focus of the empirical analysis is on the importance of foreign trade on regional growth and convergence. It is shown that different measures of foreign trade, such as the degree of openness, the share of exports to GDP, the trade balance and the growth rate of the total exports ratio to GDP significantly influence regional growth and contribute to the convergence process. However, trade with the EU countries is more significant than with non-EU members, as expected, since Portugal is a member of the EU. The fact that foreign trade measures gain significance only when they are combined with the Littoral dummy (the more competitive and more open area), reinforces the view that external trade is essential for higher regional growth. It also indicates some externality effects from the Littoral area that positively influence global regional growth and convergence. Finally, the significance of the interaction terms between human capital and foreign trade can be taken as evidence of the technology diffusion principle. It is thus required more qualified human capital to assimilate modern technologies and turn the economies more



competitive and able to participate successfully in international markets. This is in the spirit of the new reform of the cohesion policy in the EU allocating resources with the aim to increase regional competitiveness.

In another study, Poças Ana and Soukiazis Elias (2013) provide additional evidence on the determinants explaining regional growth in Portugal. Having in mind two main trends of the Portuguese economy – the ageing of the population and a strong dichotomy between littoral (the most developed regions) and the interior (the “depressed” regions) – and their consequences on the demand for public health care services, they estimated a growth model that takes into account factors related to health care, in addition with other demographic and economic determinants. The estimation approach was based on panel regressions that more properly control for specific differences between the analyzed districts. Separate growth equations are used to explain different growth performance of the littoral (the developed districts) and interior (the less developed ones) with distinct socio-economic characteristics. GMM estimations for the whole sample take into account the endogeneity problem of some regressors. Besides the expectable significant impact of the convergence factor, they found that proxies for the economic activity such as energy consumption play an important role in explaining the districts’ growth process. It is also shown that demographic and health factors play a critical role on regional growth and convergence. As expected, the ageing of population, reflected by an increase of the dependency ratio, has a significant negative impact on regional growth and this impact will be stronger in the long run if measures are not taken to improve the

fertility rate. Therefore, policy-makers should pay much more attention to this issue. Reducing cost strategies that affect fertility rates are not efficient and will be costly in the future. On the contrary, incentives to increase fertility and reverse the ageing tendency of the population are urgent. It is also confirmed a positive and significant impact of an increase in the birth rate on districts’ economic growth.

The authors find evidence that the availability of doctors and the per capita prescriptions (this last one can be seen as a proxy for population’s health status) are good predictors of regional growth at the district level. The higher ratio of inhabitants to doctors reflects more difficulties in accessing health care services and this is a common problem to most rural and more isolated areas but also to the more populated urban areas. This result also points out the need to develop policies with the aim to assure basic health care to those who need more. On the other hand, the significant and negative impact of medical prescriptions (that affects especially the littoral) can be taken as evidence of the “unhealthy” status of the population and this should also be a matter of concern.

The results of the empirical evidence of convergence among regions within a country are summarized in Table 2.3.

Table 2.3. Convergence among regions in Portugal

Authors	Sample	Period	Methodology	Results
Antunes M. and Soukiazis E. (2006)	30 NUTS3 regions	1980-2004	Conditional Convergence model with panel data	Structural funds contribute positively to regional growth but the impact is not substantial. Richer regions of the Littoral grow faster than poor regions of the Interior. The distribution of structural funds favors the Littoral
Soukiazis E. and Proença S. (2008)	NUTS2 and NUTS3 regions	1993-2001	Conditional Convergence model with panel data	Provide evidence that tourism is a factor of convergence if the supply characteristics of this sector are improved. Convergence runs between 3.67 and 5.73% per annum
Soukiazis E. and Antunes M. (2011)	NUTS3 regions	1996-2005	Growth model and convergence with dynamic panel data estimation techniques	Foreign trade is a convergence factor among regions in Portugal. Human resources transferred from the primary to the secondary and services sectors are also play an important role for regional growth.
Poças A. and Soukiazis E. (2013)	19 districts of Portugal	1996-2007	Growth models with panel data	Economic activity such as energy consumption and demographic and health factors play a critical role on regional convergence.

BRAZIL

There are a considerable number of studies that indicate the stylized facts of growth convergence in Brazil (Ferreira 2000; Azzoni 2001, Resende 2011, Cravo and Resende 2013, among others). Cravo Túlio and Soukiazis Elias (2011) study the convergence process in Brazil over the period 1985-2004, giving a special attention to the role of human capital as a conditioning factor to convergence. Using a panel data approach they examine how different levels of human capital influence growth in different regions of Brazil. Human capital measures expressed by illiteracy rate, secondary school enrolment rate, average years of school attainment, and publication rate of articles in international journals are used in the estimation approach to identify different patterns of human capital effects across different regions in Brazil.

Their results indicate that there is educational effect but this effect varies according to the sample considered. Different levels of human capital have different responses to growth depending on the level of regional development, reflecting the existence of different threshold effects that might be associated with the relative intermediate level of education in each sample. Variables that represent higher levels of human capital affect more efficiently the more developed states in Brazil.

Overall, the empirical findings suggest that the proposed human capital variables properly control the differences in the steady-states across the Brazilian states and their influence to growth depend on the level of human capital

they intent to represent. The presence of threshold effects suggests that over-qualification would be required before the economy reaches the threshold level. This implies that investment in education must be required well before education starts influencing growth. Furthermore, this investment in education must be done at the right level of human capital. Therefore, to optimally exploit resources, human capital improvements must be planned and implemented progressively.

Concerning the issue of regional inequalities and the effectiveness of regional policy in Brazil, Resende Guilherme M. (2012) develops a framework to measure the micro and macro impacts of regional development policies in this country using a panel data approach. More specifically he measures the impact of the Northeast Regional Fund industrial loans (supporting small scale firms, commerce and services) on employment and labor productivity and on GDP per capita for the period 2000-2006. He provides evidence of a positive and statistically significant impact of the Funds on job creation at the micro-level but no significant impacts on the GDP per capita growth at the macro-level. More precisely, it is found that average annual employment growth is 5.14 percentage points higher for firms supported by the funds than the non-supported firms over the period 2000-2003. However, it was not possible to find any significant impact of the funds on the wage growth (as proxy of productivity) over the total period 2000-2006. The main conclusion is that although the industrial loans played an important role in attracting and stimulating employment growth, the loans were not able to eliminate or even reduce Brazilian regional inequalities even at a lower level of spatial aggregation (municipalities, micro-regions). The positive effects of the funds at the micro-level seem to be limited and spatially located. The lack of impact of the funds at the macro-level is a case

of concern since the main goal of regional policy to reduce regional asymmetries fails to be observed questioning the effectiveness of the policy.

Thus, this short account of the growth literature on Brazil suggests that there is regional convergence of GDP per capita levels and that this process is also conditional to funds allocated to regional funds. The indication that similar phenomenon occurs in the EU is an example that the two regions can learn from each other in order to improve the design of their regional policies.

2.4. CONCLUDING REMARKS AND STYLIZED FACTS

After analyzing the convergence concepts and evaluating the convergence process through empirical studies, the following remarks can be made pointing out some stylized facts and policy orientation issues:

The smaller the geographical unit is used to measure convergence the more difficult becomes to interpret GDP per head as a proxy for the regional income per head.

Convergence is less likely to be found when the comparison is made among the smaller geographical units. That is why convergence is found to be higher among countries and lower among regions. While integration in the EU has promoted inter-national convergence, sub-national inter-regional inequalities have tended to increase (Farole T., et al., 2011).

The estimated speed of convergence is rather low when absolute convergence models are used and

higher in conditional convergence models. This shows that when differences in regional structures are controlled for (mostly in human capital, innovation, institutions, infrastructures) convergence turn to be higher.

The δ -convergence is found to take place among the EU regions, at both EU-15 and EU-27 level. The speed of convergence is not constant in time. Low values generally are found during the eighties and higher values are detected for periods before and after that decade.

Convergence is higher among the poorest regions of Europe. This is in line with economic theory stating that poor regions grow faster than the rich ones and this is because they are more far away from their steady-state level. Assisting the poorer regions is a way to speed their convergence.

The fact that regional disparities decline (δ -convergence) when considering the EU as a whole does not prevent disparities from increasing within a number of Member States, especially those that recently joined the Union (eastern European countries).

Spatial effects are in general relevant and when are taken into account (spatial autocorrelation, spatial heterogeneity) the estimated speed of convergence is more significant. This is in line with the economic geography theory, therefore regional policies that support infrastructures aiming to reduce transport costs and increase factor mobility are necessary for the growth perspective. However due to the co-funding principle that part of the project must be financed by local resources, rich regions could be the ones that benefit more from structural funds. On the other hand, better transport infrastructures could benefit the more competitive regions from the trade

perspectives. Hence, the final result could be an increase in regional disparities if these tendencies work in favor of the more advanced regions.

Spatial dependence is higher between the core regions in the EU than in the peripheral regions benefiting higher growth diffusion and externality effects through a causal cumulative growth process. This calls for the necessity that regional policy in the EU must take into account spatial dependence among regions when reallocating structural funds with the aim of reducing regional asymmetries and help backward regions to develop farther.

To measure the impact of structural funds on regional growth and convergence it necessary to consider the different resource endowment across regions in terms of infrastructure, human and knowledge capital with which the structural funds themselves interact.

Structural Funds expenditures can improve basic infrastructures in backward regions and increase its economic competitiveness. Structural Funds expenditures may influence long-run growth affecting the conditional factors included in the convergence equation. In this context, it may increase the regional investment rate through the capital-deepening process eventually leading to higher steady-state per capita capital and GDP growth. But most importantly it can increase the human capital and knowledge stock which in turn improves the regional total factor productivity by affecting also the growth rate of technology.

The allocation of structural funds must take into account the costs and benefits of being a member of the Union. More developed regions (core EU regions) are more competitive regions obtaining higher trade and growth benefits. Therefore they



should accept to contribute more in the Union's budget and transfer financial resources to the backward regions (peripheral regions).

Structural funds reallocation must be growth enhancing by increasing regional competitiveness. The funds must be invested in human capital qualifications, innovation, health and environmental improvements in order to achieve higher convergence and sustainable regional growth. This is consistent with the last reform of Regional Policy in the EU moving away from an income redistribution support towards a higher regional competitiveness strategy. The funds support agriculture and rural development, business and tourism, investment in education and training, and investments in infrastructure, transport and environment.

Structural funds are more efficient when are allocated to regions (countries) with good institutions and benefiting from a good economic environment, such as low unemployment and high R&D capabilities (Ederveen et al. 2006).

The most striking and unanimous evidence from the literature is that investment in human capital tends to reduce regional inequalities more than investment in infrastructures (Barro and Sala-i-Martin 1995; Rodriguez-Pose and Fratesi, 2004). This is in line with economic theory that human capital is a factor of production with increasing returns properties in the long-run that compensate the diminishing returns of physical capital. On the other hand, although infrastructures are important from the point of view of increasing linkages and communication among regions, they are considered as being investments in non-tradable sector and involving high import content. Investments cannot be exaggerated in these sectors and a threshold level must be considered when structural funds are allocated.

Structural funds allocation must avoid some undesirable consequences, such as: market distortions due to investments in inefficient sectors with no local comparative advantages; crowd out private investment; shelter regions from markets; create a dependency culture where regions rely on transfers as an income support policy that favors consumption but not productive output; benefiting existing elites and clientelistic institutions; in general, policies that have few growth-enhancing properties (Farole T., et al., 2011).

Any revision of regional policy in the EU should take into consideration the risks associated with an excessive focus on only one development axis, often having political or national interests. There is a need of rethinking regional policy towards the implantation of more innovative and region-specific development strategies. This implies to develop a more locally combination of investment priorities across axes, avoiding premature exposure to the market, loss of human capital resources or subsidizing non-competitive local firms through business support. European Union has also a role in contributing to making local institutions more capable and accountable to commitments undertaken, removing administrative constraints that work against the principles of the EU regional policy.

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3. THE BRAZILIAN REGIONAL CONSTITUTIONAL FUNDS AND REGIONAL ECONOMIC GROWTH: EVIDENCE AND CHALLENGES AHEAD

Brazil is a country with striking regional inequalities and many government-sponsored initiatives have been created to tackle this issue. For instance, the regional development funds for the Northeast (FNE), the North (FNO), and the Central-West (FCO) are very important for the regional development policy and were responsible for more than €36 billion invested in lagging regions between 2004 and 2010. These funds seek to facilitate the economic and social development of lagging regions by offering loans below market interest rates, primarily, to small-scale farmers and small industrial firms. This chapter presents a discussion about the goals and the evidence of the impact of regional policy in Brazil, paying particular attention to the evidence about the constitutional funds on growth. The chapter concludes presenting a discussion about challenges that lie ahead of the way leading to better monitoring and evaluation of constitutional funds.

3.1. THE NEED FOR REGIONAL POLICIES

Large regional disparities hinder regional integration in large economic areas. Market forces alone seem to be ineffective at reducing regional inequality and government-sponsored initiatives are designed in different parts of the globe to promote integration. The cases of the European Union (EU) and Brazil are two interesting cases of large economic areas with striking regional inequalities.

For instance, in the European Union (EU), the regional policy is an important instrument to reduce regional disparities among its Member States⁹. The EU currently uses about one third of its total budget to run Cohesion Policy with the objective of promoting overall harmonious development and in particular to reduce regional disparities across the Union. The Cohesion Policy assistance for the period 2006-2013 was around €308 billion. Similarly, Brazil is also a large economy but with more severe regional inequality. In this context, regional policy emerges as an important social and economic tool aiming at reducing striking inequality. One of the most significant initiatives is the creation of the regional funds for the northeast (FNE), center-west (FCO), and the north (FNO) regions. The funds were created by

9. The Lisbon Treaty (2000) confirm the European goals of economic and social cohesion and added territorial cohesion to these initial goals. The consolidated Treaty on the Functioning of the European Union in its article 174 states: "In order to promote its overall harmonious development, the Union shall develop and pursue its actions leading to the strengthening of its economic, social and territorial cohesion. In particular, the Union shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions. Among the regions concerned, particular attention shall be paid to rural areas, areas affected by industrial transition, and regions which suffer from severe and permanent natural or demographic handicaps such as the northernmost regions with very low population density and island, cross border and mountain regions."



following the directives of the Federal Constitution of 1988.¹⁰ These resources are transferred from the National Treasury to the operating bank via the Ministry for National Integration (MI). The constitutional funds invested more than €36 billion between 2004 and 2010.

Given the importance and scale of some regional policy initiatives, many studies analyzing the impact of regional policies have emerged. For the European case, Cappelen et al. (2003), Soukiazis and Antunes (2004) and Rodriguez-Pose and Fratesi (2004), for instance, provide earlier discussion on the evidence about the EU structural funds, which is the most significant initiative of regional policy in Europe.¹¹ Nevertheless, these studies did not explicitly consider spatial dependence in the estimations and were complemented by recent studies that took into account spatial dependence and spillovers (e.g. Ramajo et al., 2008; Mohl and Hagen, 2010) and suggest that regional policy has to be analysed taking into account spatial dependence in a more explicit manner.

The current regional disparities in Brazil are a result of a historical process linked to the concentration of the industrialization process in São Paulo at the beginning of the 20th century and that reached its peak in the 1970s. After that decade, as noted by the Documento de Referência (2012) of the Secretary of Regional Development, the main types

of instruments used to spur regional development and reduce inequalities were: i) fiscal incentives for lagging regions (northeast, north and center-west); ii) infrastructure development (e.g. transport, energy, telecommunication) and iii) productive investments made by state owned enterprises.

The federal government used state owned firms as tools aiming at regional development, a strategy that was intensified during the Plano de Metas in the 1950s and more strongly during the II PND in the 1970's. This model had achievements but also suffered criticism as these massive investments created intraregional imbalances. The infrastructure development from the 1950s onwards allocated significant amount of resources in lagging regions. This strategy contributed to the expansion of productive activities, namely the expansion of the agriculture frontier in the center-west region. Finally, an important instrument aiming at reducing regional inequality takes form in fiscal incentives that were provided for lagging regions. The federal government introduced many significant fiscal incentives in the 1960s with the creation of SUDENE, SUDAM, SUFRAMA and later with the constitutional funds in 1988. This report focus on the latter, which is one of the most important instruments of the regional policy in Brazil.

The regional policies had limited importance after the 1980s due to the fiscal crises of the federal government and more free market oriented policies. With the rising of regional disparities during the 1990s, the regional policy started to be present in the government agenda after the second half of the 1990s. In 2004 the PNDR was launched and later institutionalized in 2007. Nevertheless, despite significant efforts made over decades, Brazil still presents outstanding regional inequality. In an effort to structure a national strategy aiming at

10. Article 159. The Union shall remit: (CA No. 42, 2003; CA No. 44, 2004; CA No. 55, 2007) I – of the proceeds from the collection of the tax on income and earnings of any nature and of the tax on industrialized products, forty-eight per cent as follows:c) three per cent, for application in programs to finance the productive sector of the North, Northeast and Centre-West Regions, through their regional financial institutions, in accordance with regional development plans, the semi-arid area of the Northeast being ensured of half of the funds intended for that Region, as provided by law.

11. Pinho et al. (2013) discusses in more detail the mixed evidence from empirical research on EU structural funds.



regional development, the PNDR II was structured based on four main objectives: i) promote income convergence. ii) Guarantee regional competitiveness and employment and income generation in areas with population decline and high emigration rate. iii) Increase value added in the production chain and promote economic diversification with strong specialisation in the production of agriculture and mineral commodities. iv) Consolidate the network of polycentric cities that contribute to the decentralization of economic activity and expansion of development for the interior of the country. According to Leite (2011), the new phase of the PNDR is related to the strategy to elevate the status of the regional policy from a government policy to a state policy. In this context, Leite (2011) argues that the main instruments of PNDR aimed at financing the productive sector are the constitutional funds.

The regional constitutional funds, one of the most significant regional policy instruments in Brazil, have been evaluated such as the European Structural Funds. The studies by Almeida et al. (2007) and Silva et al. (2007, 2009) provided the first wave of evaluation of constitutional funds in Brazil with data from early 2000's. Other studies followed and Resende (2014a) analysed the impact of constitutional funds at firm and regional levels considering the aggregation bias and Modified Aerial Unit Problem (MAUP). Recently, Resende (2014b) and Resende et al. (2014) provided evidence from a new wave of studies about the constitutional funds that emerged as the data coverage period and quality improved and because the resources allocated to the constitutional funds increased considerably due to the expansion of the Brazilian economy over the last decade.¹² Nevertheless, the literature

that analyses the relationship between regional economic growth and the constitutional funds does not consider explicitly spatial dependence. The recent literature that analyses regional economic growth in Brazil suggests the presence of significant spatial dependence and indicates the use spatial econometrics to deal with this issue (e.g. Silveira-Neto and Azzoni, 2006; Resende, 2011, Cravo and Resende, 2013; Cravo et al., 2014). Thus, studies that analyze the impact of constitutional funds on growth should control for spatial dependency. Statistically, the omission of spatial dependence and spillovers in growth regressions produces biased results, as argued by Rey and Montouri (1999), and requires spatial econometrics to be estimated correctly.

Therefore, the aim of this chapter is to provide a brief review of the literature that evaluates regional policies in Brazil and pinpoint challenges that are ahead in terms of monitoring and evaluation.

The remainder of the chapter is organized as follows. The 3.2 section reviews the literature of constitutional funds and economic growth. Section 3.3 presents the challenges that lie ahead in terms of the evaluation of regional policies and constitutional funds. The last section concludes.

3.2. LITERATURE ON REGIONAL FUNDS

This section reviews the available evidence on constitutional funds and presents the points in which this report can further the knowledge on the regional impact of regional funds. Despite

12. Although there are many examples of studies analyzing the impact of constitutional funds, these initiatives were usually done detached from a

broader strategy to monitor and evaluate regional policy in Brazil.



recent efforts to assess the impact of constitutional funds, the literature about the issue is still scant. Also, most of the work done on the issue used data until the mid-2000's, a period characterized by low disbursement rate of constitutional funds resources (Almeida et al., 2007).

Earlier studies on the constitutional funds were more descriptive and Jayme Jr and Crocco (2005) point out that the descriptive analysis of the constitutional funds indicates a concentration of credit in more developed regions and stronger preference liquidity in those regions. In addition, Oliveira and Domingues (2005) suggest that the impact of the funds are concentrated in richer municipalities. Macedo and Matos (2008) provide an analysis based on descriptive statistics and also suggest that constitutional funds are allocated to the richer cities of the eligible regions, suggesting that the funds might reinforce regional income inequality.

Researchers also looked at the impact of constitutional funds at firm level. Silva et al. (2009) indicate that firms financed by constitutional funds experienced some positive employment growth only in the Northeast. Resende (2014a) complements this work and provides evidence of the impact of the constitutional funds at firm and regional level in order to take into account the problems related to aggregation bias and the MAUP that emerge from observing different results at different aggregation levels. The results indicate that positive effects at firm level do not spillover at regional level.

The work of Galeano and Feijó (2012) complements the existing evident of the impact of constitutional funds by providing insights on the impact of the combination of these funds with credit lines provided by the Brazilian Development Bank. Their paper uses aggregated data at state level and results suggest

that the combination of these lines of credit affect GDP per capita and productivity only in the Center-West region of Brazil. Nevertheless, they did not provide a separate evidence for the regional impact of constitutional funds alone.

More recent and better quality information about the constitutional funds opened up possibilities for the assessment of the impact of the funds over a broader period that includes a decade of continuous economic progress in Brazil. Also, the new data considers the different types of credit lines by sector. Resende (2014b) assess the impact of the constitutional fund of northeast (FNE) at various regional scales to consider the MAUP. The results show a positive and statistically significant impact of the FNE on the GDP per capita growth at the municipal and micro-regional level. There is no effect of FNE funds at the larger geographic scale of meso-regions. Also, the results suggest that the positive effects of FNE are largely influenced by the performance of the FNE loans to the agricultural sector.

Similarly, Resende et al. (2014) present new evidence for the constitutional fund of center-west (FCO). The results of the fixed effects panel data estimations show that FCO impacts positively GDP per capita growth only at municipal level and results suggest that this positive effect is mainly influenced by the specific FCO line of credit aiming at the service sector. The results for micro and mesoregions suggest that FCO does not stimulate economic growth in more aggregated regions.

3.3. CHALLENGES AHEAD

The evidence listed in the previous section provides a considerable amount of evidence on the impact



of the constitutional funds on regional performance. Nevertheless, the effort to provide a thorough evaluation of the regional policy and constitutional funds are still limited in some aspects.

Firstly, the academic work produced about regional policy is not framed into a broader context of a structured monitoring and evaluation system (M&E). The consolidation of the M&E system related to this area can guide the academic and policy work produced and might be an important tools to better understand and learn about regional policy in Brazil.

Secondly, most of the studies quoted above do not take into account the issue of spatial dependence or the distortions of the results likely due to the Modifiable Areal Unit Problem (MAUP). Those empirical issues are a well known factors that influence the results of the evidence on regional growth in Brazil and should be incorporated in the studies that focuses on regional policies in Brazil.

3.3.1. IMPROVEMENTS OF CURRENT STUDIES

A clear strategy to verify the impact of constitutional funds on regional economic growth using the same data aggregated at municipality and micro-regional level by systematically repeating a method used to examine this phenomenon across multiple scales is required to provide a clear picture of the effects of regional policies. This allows researchers to investigate the measurement issue that might cause variability in the impact of the constitutional funds on regional economic growth estimates due to the use of different spatial scales, likely due to the Modifiable Areal Unit Problem (MAUP).

The MAUP problem was thoroughly studied for

the case of Brazil in Resende (2011). The author provides a clear exercise using growth regressions to show how results might change according to the regional unit of analysis. These results is of extreme importance and it suggests that researchers might find different results for aspects of regional policy depending on the level of aggregation of the data. Thus, the evaluation of regional policy in Brazil should consider the MAUP in order to provide a complete account about the reach of the regional policies by analyzing their effects in different levels of geographical aggregation. It is interesting to note that the MAUP is also a phenomenon important and usually ignored in the studies focusing on the EU regions. Resende and Cravo (2013) provide a discussion about how the MAUP affects the results of growth regressions for the EU regions. Thus, institutional cooperation among EU and Brazil in the area of regional policy should include the MAUP in the agenda as it is a common and important issue for both economies.

The baseline model used in most of the regional policy evaluations rely on the neoclassical growth model based on Solow (1956) and Mankiw et al. (1992). The specification usually considers a generalization of the neoclassical growth model that encompasses other factors that influence growth (e.g. Barro, 1991; Temple, 1999; Sala-i-Martin, 2002). Many evaluations of regional policy follow this strategy (e.g. Cappelen et al., 2003; Soukiazis and Antunes, 2004; and Rodriguez-Pose and Fratesi, 2004; Resende 2014b) and the baseline model for the evaluation of constitutional funds.

However, the literature on the issue is still limited in some aspects. For instance, most of the studies quoted above do not take into account the issue of spatial dependence that is a well known factor that influences regional growth in Brazil or the EU. This



analysis is very important to assess the extent to which any positive impact of constitutional funds might spillover in neighbouring regions, especially if the analysis considers data that encompasses the period in which there were more resources allocated to the funds due to a decade of continuous economic growth in Brazil. Empirically, one manner to consider the spatial dependence is through the use of the spatial econometrics estimators.

The use of spatial panel econometrics represents a step forward in the estimation of impact of the constitutional funds as it considers possible interregional relationships. Importantly, many academic studies already demonstrated the importance of spatial dependence in Brazil and the EU. Thus, the consideration of spatial dependence in the context of regional policies is also a common point in the agenda of both economies. Nevertheless, the evaluation of regional policies should not be done occasionally and detached from the broader context of the regional policy and should be accompanied by a monitoring and evaluation (M&E) system.

3.3.2. MONITORING AND EVALUATION SYSTEM AND THE REGIONAL POLICY

Monitoring and evaluation techniques are important as they provide statistical tools that allow for learning and the improvement of the interventions (Gertler et al., 2011). The principles of the National Policy of Regional Development (PNDR), that encompasses the constitutional funds, follow the National Plans (e.g. education and health) and the federal public policies and recognize the importance of monitoring and evaluation of policies. These principles state that M&E should be undertaken by competent bodies and require the definition of objectives and

targets, accompanied by indicators designed to measure impact.

The culture of M&E and PM is relatively new in Brazil. At the national level, the Ministry of Planning, Budget and Management (MPOG) started significant initiatives to implement a culture of results-based management on sectoral public policy in the Multi-Year Plan 2000-2003. An important innovation was the inclusion of indicators on implementation and results based on concepts of M&E.

Brazil also experienced recent institutional changes that affected the demand for M&E and PM services. The creation of the Office of the Comptroller General (Controladoria-Geral da União-CGU) in 2002 stimulates transparency and better M&E of public resources. CGU randomly selects municipalities to audit public expenditures and enforce transparency. The Brazilian Court of Audit (TCU) also has an important role to monitor the adequate and effective use of public funds using auditing tools, case studies and focal groups (Borges et al., 2011).

Important sectoral ministries followed this trend and the Ministry of Social Development (MDS) created the Secretariat of Evaluation and Information Management (SAGI) specialized in information management and evaluation in 2004 (Natalino, 2013). Some other areas of public sector advanced and also provide clear guidance to develop capacities in M&E. The Ministry of Education and Science (MEC) and Ministry of Health (MS) have developed capacities in M&E and the Ministry of Science, Technology and Innovation (MCTI) recently approved the creation of the permanent commission for M&E (see Portaria number 137, 19 of February 2013).

This tendency to develop M&E systems in



government bodies also applies to the MI. The Observatory of Regional Development (ODR) is an important initiative of MI in the area of M&E. The ODR already encompasses an online platform with a panel of indicators related to the regional policy in Brazil. The improvement of this tool can significantly contribute to the continuous development of the M&E culture within the MI. The ODR can be improved, for instance, by incorporating a development effectiveness matrix that considers the possible causal relationship between the objectives of the regional policies and the panel of indicators. The establishment of this possible logical chain of effects is known as the theory of change and the guidelines in this subject that are used in multilateral development institutions are useful references for the improvement of M&E related to regional policies (e.g. ECG; 2012, IEG, 2012; OECD, 1991). Importantly, statistical methods that allow researchers and policy makers to infer the causality of the interventions should be used when possible.

3.4. CONCLUDING REMARKS

This chapter reviews the evidence available in Brazil related to its regional policy and points out future challenges to be consider in a broader context of the evaluation of regional policy. The evidence reviewed shows that constitutional funds affect regional growth mainly in smaller territorial scales, indicating that policy makers have to consider the objectives of the regional policy in the light of their geographical reach.

The use of the new data on the constitutional funds opened up the possibility to investigate the effect of different types of constitutional funds on economic growth. The recent studies using the new data indicate that the effect of different modalities

of constitutional funds are not uniform, this evidence suggests that policy makers should better understand the effectiveness of different modalities of the funds to maximize its regional impact.

Finally, the chapter pointed out some challenges that lies ahead in order to improve technical aspects of regional evaluations and the overall monitoring and evaluation system related to the regional policy. Further exploration of the data of the constitutional funds considering the existence of spatial spillover is a research avenue that might produce important results that might influence the design of better guidelines to make more effective use of the constitutional funds. In addition, the further development of current monitoring and evaluation instruments of the Ministry of Integration, namely the Observatory of Regional Development, is a natural step that can complement current efforts made to evaluate regional policy in Brazil.



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4. THE IMPACT OF BRAZILIAN REGIONAL DEVELOPMENT FUNDS ON REGIONAL ECONOMIC GROWTH: A SPATIAL PANEL APPROACH

In Brazil, the regional development policy is directed by the regional development funds for the Northeast (FNE), the North (FNO), and the Central-West (FCO), which invested more than €36 billion in lagging regions between 2004 and 2010. This policy seeks to facilitate the economic and social development of lagging regions by offering loans below market interest rates, primarily, to small-scale farmers and small industrial firms. This chapter evaluates the economic impact of these Regional Funds using for the first time unique and recent data provided by the Brazilian Government. The study uses the different spatial scales of municipalities and micro-regions to analyse the impact of Regional funds on GDP per capita growth between 2004 and 2010. The results of the panel data estimations suggest that constitutional funds have some positive impact on GDP per capita growth mainly at municipality level, which is the smallest spatial scale. Nevertheless, the results estimated by fixed effect estimations neither control for spatial dependence nor provide evidence on the magnitude of the spatial spillover stemming from the Regional Constitutional Funds. Thus, to control for these caveats, this chapter also applies the Spatial Econometrics estimator for

panel data suggested by Elhorst (2010). The results indicate that different modalities of FCO, FNO and FNE affect regional growth differently and the spatial estimations did not indicate the existence of spatial spillovers stemming directly from the constitutional funds.

4.1. EMPIRICAL EVALUATION OF CONSTITUTIONAL FUNDS

The previous chapters provided a review of the literature reporting large regional disparities that might hinder regional integration in large economic areas as in Brazil and the EU. Market forces alone might not be effective at reducing regional inequality and regional policies are designed to promote integration.

Nevertheless, the focus were on the previous sections were on the process of regional integration in the EU, evidence of the literature on the EU and Brazil about the impact of regional policies and future challenges to assess regional policies. In a different manner, this chapter has an empirical nature. The aim is to provide an analysis of the importance of the constitutional funds for regional economic growth in Brazil from 2004 to 2010, considering the spatial dependence and also the MAUP mentioned in the previous chapter. The research will use a new and unique data made available by the Brazilian Government and provide for the first time empirical evidence on the importance of space for the relationship between constitutional funds and regional economic growth process in Brazil using spatial panel econometrics estimators suggested by Elhorst (2010).

The remainder of the report is organized as follows.

Section 4.2 presents the data of the constitutional funds. Section 4.3 discusses the empirical methodology to assess the relationship between constitutional funds and economic growth taking into account the spatial dependence within the model by using spatial econometrics. Section 4.4 presents the results and the last section concludes.

4.2. CONSTITUTIONAL FUNDS AND DATA

The constitutional funds are allocated to productive activities in the North, North-East and Center-West regions of Brazil. The funds were created to spur regional and social development in the three least developed regions of the country through subsidised credit lines.¹³ As mentioned before, the constitutional funds were created by following the directives of the Federal Constitution of 1988 and were constitutionalized in the article 159. The funds were then regulated by the law 7.827 of 27th of September 1989. The resources designated to the constitutional funds are managed by the Ministry of National Integration (MI) and loan operations are carried out by authorized banks.

The resources allocated to FNO, FNE and FCO come from the collection of the tax on income (IR) and earnings of any nature and from the tax on industrialized products (IPI). Three per cent of the revenue of IPI and IR is allocated to the fund as follows: 60% assigned to FNE, 20% to FNO, and 20% to FCO. In addition, resources from repayments of the loans are reinvested in the funds.

13. For instance, interest rates for the investment loans in the credit line "programa FNO-Amazônia Sustentável" for rural micro entrepreneurs was 3,53% per year (Basa, 2012), less than a half of the Brazilian Central Bank reference interest rate (SELIC) that was 7.25% in December 2012.

The directives and implementation strategies change slightly according to the constitutional fund.¹⁴ As well, different operators lend the resources from the Constitutional funds according to the region. The institution responsible for the operation of the FNO is the Bank of the Amazon (BASA), a state owned regional development bank. The priority of FNO is to finance small entrepreneurs, mainly familiar agriculture, businesses that use local raw materials and workers and that produce food for the local economy (Basa, 2010, p. 15). Similarly, the Bank of the Northeast (BNB) is the development bank that manages the FNE. The guidelines give priority for the loans that: i) support "Arranjos Produtivos Locais", ii) are located in priority areas as defined by National Plan of Regional Development (PNDR)¹⁵ iii) support smallholder farmers that are eligible by the Programa Nacional de Fortalecimento da Agricultura Familiar (PRONAF), and iv) support urban self-employed and micro and small businesses (BNB, 2013). Finally, the FCO loans are managed by the state owned Bank of Brazil. The FCO's guidelines give priority for the loans that:¹⁶ i) support familiar agriculture and smallholder farmers. ii) have high potential for employment and income generation and/or are related to solidarity economy that contribute to the dynamic of local labour market and the reduction of inequality. iii) are for projects aiming at environmental conservation. iv) use innovative technology to generate and disseminate technology in business and agriculture sectors. v) modernize and expand tourism infra-structure in the 2014 FIFA

14. In general, constitutional funds are available for self-employed, micro and small entrepreneurs, rural producers and associations and cooperatives.

15. Projects localized in semi-arid regions, priority regions defined by the MI, in the regions defined as Regiões Integradas de Desenvolvimento (Rides) and in regions defined as priorities by the National Policy of Regional Development (PNDR) (low income, stagnated and dynamic). In addition, as defined by law, 50% of FNE loans must be allocated to semi-arid areas of the northeast region.

16. Source: <http://www.sudeco.gov.br/fco>.



World Cup host cities. vi) contribute to the reduction in inequality in priority areas as defined by the National Plan of Regional Development (PNDR).

Table 4.1 below shows the lending portfolio with resources from the constitutional funds by year between 2004 and 2010. The total lending amount over the period reached R\$ 81.9 billion and FNE, the biggest constitutional fund, accounted for R\$ 50.3 billion (60% of the total). This amount is equivalent to 13.5% of the Northeast region GDP in 2004. The FCO is the second largest constitutional fund and the loans approved over the period amounted to R\$ 19.4 billion, 23% of the amount allocated to constitutional funds overall. Finally, the FNO is the smallest fund of this sort and the loans approved between 2004 and 2010 amounted to R\$ 13.2 billion, representing 16% of the constitutional fund lending amount over the period. Interestingly, the numbers show that the yearly lending amount for FNE doubled from 2004 to 2010. This is influenced by a decade of continuous growth that increased the tax revenue in the country. As the resources allocated to constitutional funds are defined in the constitution as a fixed share of tax revenue, this prosperous economic period led to substantial increase in the resources available for the funds.

The amount allocated to different categories of each constitutional fund is also shown in Table 4.1. About 42% of FNE loans were provided to entrepreneurs in the agriculture sector (FNE agriculture), while 25% went to the manufacturing sector (FNE manufacturing), 20% to commerce and services modality and

only 13% to infrastructure projects.¹⁷ Similarly, 51% of the FNO loans benefited the agriculture category, followed by manufacturing (18%), commerce and service (18%), infrastructure (10%) and export (2%). The FCO loans have less categories but are also concentrated in agriculture sector, despite the fact that the share of FCO business loan type constantly increased over time.

17. The evaluations of FNE-infrastructure, FNO-infrastructure and FNO-exports are not carried out in this report.

Table 4.1 – Constitutional Funds Lending (2004-2010), by FNO, FNE and FCO and Modality of Loan

	2004	2005	2006	2007	2008	2009	2010	Total	Total
FNO (R\$ in million, constant price in 2010)									
FNO rural	1.227	913	714	853	1.116	951	959	6.731	
Share (%)	68	70	56	64	49	35	37	51	
FNO manufacturing	218	217	271	251	517	678	320	2.473	
Share (%)	12	17	21	19	23	25	12	19	
FNO service/commerce	81	114	153	177	624	509	775	2.432	
Share (%)	4	9	12	13	28	19	30	18	
FNO infrastructure	70	3	140	48	1	574	515	1.350	
Share (%)	4	0	11	4	0	21	20	10	
FNO export	203	64	0	0	6	0	0	273	
Share (%)	11	5	0	0	0	0	0	2	
FNO total	1.798	1.310	1.277	1.328	2.264	2.712	2.568	13.258	15.99%
Share (%)	100	100	100	100	100	100	100	100	
FNE (R\$ in million, constant price in 2010)									
FNE agriculture	1.837	2.956	3.165	2.616	3.336	3.586	3.866	21.362	
Share (%)	42	53	53	52	40	35	36	42	
FNE manufacturing	1.595	1.807	1.338	863	1.929	1.99	2.868	12.39	
Share (%)	37	33	23	17	23	20	27	25	
FNE service/commerce	931	776	889	1.071	1.739	2.439	1.988	9.833	
Share (%)	21	14	15	21	21	24	19	20	
FNE infrastructure	0	0	550	523	1.433	2.137	2.02	6.663	
Share (%)	0	0	9	10	17	21	19	13	
FNE total	4.364	5.539	5.942	5.074	8.437	10.151	10.742	50.248	60.59%
Share (%)	100	100	100	100	100	100	100	100	
FCO (R\$ in million, constant price in 2010)									
FCO rural	1.025	1.395	1.234	1.396	2.307	2.108	1.983	11.448	
Share (%)	64%	71%	66%	59%	60%	60%	47%	59%	
FCO business	570	575	636	966	1.518	1.434	2.271	7.971	
Share (%)	36%	29%	34%	41%	40%	40%	53%	41%	
FCO total	1.595	1.970	1.871	2.362	3.825	3.543	4.253	19.419	23.42%
Share (%)	100%	100%	100%	100%	100%	100%	100%	100%	
Total Constitutional Fund	7.757	8.819	9.09	8.764	14.526	16.406	17.563	82.925	

Source: Ministry of National Integration (MI). Authors' elaboration. The paper kept the original nomenclature of the regional constitutional funds. For instance, FNO rural and FNE agriculture have similar objectives and target the agriculture sector, however they have a different name according to the region.

The data used in this study is provided by MI under an agreement with the Institute of Applied Economic Research (IPEA), which is the institution responsible for carrying out the study. From the raw information on the lending portfolio of constitutional funds provided by MI, this research constructed the share of the lending amount of constitutional fund over regional GDP per capita. This share was constructed for different sub-periods and for the different types of lending shown in Table 4.1.

Table 4.2 shows the Global Moran's I, the statistic used to test for spatial dependence, which was calculated for the constitutional funds and GDP per capita at municipality and micro-regional geographic scales. As expected, the data show very strong spatial correlation; the null hypothesis of no spatial correlation is rejected at the significance level of 1% for all variables. These numbers show that the resources are not allocated in a homogenous manner across regions, suggesting that existence of spatial dependence. The values of the share of constitutional funds over GDP are correlated in the space. This is an initial suggestion that methods that take into account spatial dependence might be more appropriate to assess the relationship between the constitutional funds and regional growth. Interestingly, FCO presents stronger spatial autocorrelation as FNE is less dependent on spatial location. This is in line with the results of Resende et al. (2014) that shows that the resources of FNO are concentrated in geographic areas of the Center-West of Brazil.

Table 4.2 Test for spatial autocorrelation (Moran's I) of Constitutional Funds (2004-2010) and GDP per capita (2004-2010)

	MUNICIPALITY	MICRO-REGION
FCO	0.392 ***	0.510***
FNO	0.376***	0.284***
FNE	0.117***	0.200***
GDPpc Growth	0.102***	0.127***

Note: p -value <0.10 ; ** p -value <0.05 ; *** p -value <0.01 . Moran's I calculated using the squared inverse distance between the centroid of the regions.

The construction of the rich data used in this chapter is a significant effort to provide a panel data that identifies

different categories of constitutional funds during a period of a significant increase in the financial resources available to these funds. This new data is very important to assess one of the main tools of regional policy in Brazil and this report innovates as it is one of the first studies that use this data to analyze the impact of the funds on Brazilian regional development taking into account spatial dependence in a panel data setting.

4.3. METHODOLOGY

Monitoring and evaluation techniques are important as they provide statistical tools that allow for learning and the improvement of the interventions (Gertler et al., 2011). In this chapter, we seek to verify the impact of the constitutional funds on regional economic growth using the same data aggregated at municipality and micro-regional level by systematically repeating a method used to examine this phenomenon across multiple scales. This allows us to investigate the measurement issue that might cause variability in the impact of the constitutional funds on regional economic growth estimates due to the use of different spatial scales, likely due to the Modifiable Areal Unit Problem (MAUP).

The baseline model stems from the neoclassical growth model based on Solow (1956) and Mankiw et al. (1992). The specification used in this study is the common ad hoc regression that is considered a generalization of the neoclassical growth model that encompasses other factors that influence growth (e.g. Barro, 1991; Temple, 1999; Sala-i-Martin, 2002). Many evaluations of regional policy follow this strategy (e.g. Cappelen et al., 2003; Soukiazis and Antunes, 2004; and Rodriguez-Pose and Fratesi, 2004; Resende 2014b) and the baseline model takes the following form:

$$gr_{it} = -\beta \ln y_{i,t-1} + \psi \ln X_{it} + \phi \ln CF_{it} + \alpha_i + \mu_t + u_{it} \quad (1)$$

where gr denotes the annual GDP per capita growth, $\ln y_{t-1}$ is the initial GDP per capita, β the convergence coefficient, CF is the share of constitutional funds over GDP in each region and ϕ the coefficient that captures the impact of CF on growth. Furthermore, i denotes each individual region, t represents each period of time considered and u_{it} is the error term $\sim N(0, \sigma^2)$. The vector X represents a set of control variables that encompasses growth determinants suggested by the Solow model as well as growth determinants that come from outside this model. The variables included in this vector are the average year of schooling of workers and population density.

The data for the panel estimations are organized in intervals over the period 2004-2010 to minimize business cycle influence (Casseli et al., 1996). Three sub-periods are considered and the panel is constructed based on the average of the dependent variable and CF over the following periods: 2004-2006, 2006-2008 and 2008-2010. The remaining conditioning variables are considered at the initial year of each interval to control for endogeneity.

As mentioned earlier in this section, researchers include the regional policy treatment as an additional growth

determinant. Thus, the additional feature of the specification is the inclusion of the value amount of the constitutional fund (CF) in equation 1. However, Equation (1) ignores the existence of spatial dependence in the regional growth process and instead assumes that regional observations are independent, which results in major model misspecification (Rey and Montouri, 1999).

The Model Specification with Spatial Dependencies

There are many ways to consider the spatial dependence in Equation (1). The most common specifications in spatial econometrics according to Lesage and Pace (2009) are the spatial error model (SEM), the spatial autoregressive model (SAR) and the spatial Durbin model (SDM). The first considers the spatial dependence in the terms and Equation (1) becomes:

$$gr_{it} = -\beta \ln(y_{i,t-1}) + \psi \ln X_{it} + \alpha_i + \mu_t + \varepsilon_{it} \quad (2)$$

$$\varepsilon_{it} = \lambda \sum_{j=1}^N w_{ij} \varepsilon_{jt} + v_{it}$$

where the variables are defined as in Equation (1), but hereafter to simplify the notation, **CF** is also included in the vector **X**. The term ε is the error term, where w_{ij} contains information about the spatial structure and connectivity between regions **i** and **j**, λ is a scalar spatial error coefficient, and $\mathbf{u} \sim N(0, \sigma^2 \mathbf{I}_n)$. A random shock in a specific region also affects growth rates of other regions through the transformation in the error term (Rey and Montouri, 1999; Ertur et al., 2006).

An alternative way of considering the spatial dependence is through the spatial lagged values of the dependent variable in the SAR specification:

$$gr_{it} = \rho \sum_{j=1}^N w_{ij} gr_{jt} - \beta \ln(y_{i,t-1}) + \psi \ln X_{it} + \alpha_i + \mu_t + v_{it} \quad (3)$$

where ρ is the spatial autoregressive parameter and all other terms are defined as in Equation 2. Lesage and Pace (2009) argue that this distinctive spatial econometrics specification and can be extended into the SDM specification that has the advantage of allowing for spatial effects working through the dependent variable, the initial income variable, and a set of conditioning variables:

$$gr_{it} = \rho \sum_{j=1}^N w_{ij} gr_{jt} - \beta_1 \ln(y_{i,t-1}) + \beta_2 \sum_{j=1}^N w_{ij} \ln(y_{j,t-1}) + \psi_1 \ln X_{it} + \psi_2 \sum_{j=1}^N w_{ij} \ln X_{jt} + \alpha_i + v_{it} \quad (4)$$

where everything is defined as in Equation (3), with the inclusion of the vectors WnX_{jt} and $Wn(y_{i,t-1})$ used to account for the spatially lagged values of all conditioning variables.

This is an attractive specification because if $\psi_2 = 0$ and $\beta_2 = 0$ it becomes the SAR model, and if $-\rho\psi_1 = \psi_2$ and $-\rho\beta_1 = \beta_2$ the model is reduced to the SEM model. These restrictions are tested using a Wald test. Lesage and Fisher (2008), Lesage and Pace (2009) and Elhorst (2010b) provide a detailed discussion about the motivations and advantages of the SDM specification for growth models from a statistical point of view. They show that the use of an SDM specification rests on the plausibility of two circumstances that are likely to arise in applied regional spatial growth regressions: the spatial dependence in the disturbances of an OLS regression, and endogeneity in the form of an omitted explanatory variable (that follows a spatial autoregressive process) that exhibits non-zero covariance with the variables in the model. These plausible circumstances observed in applied spatial growth regressions make the SDM model the econometric choice over competing alternatives.

Thus, inferences are based on the maximum likelihood estimator proposed in Anselin (1988) and extended for panel data by Elhorst (2010a). Panel data models have advantages over cross-section ones as they have more degrees of freedom, can control for individual and time fixed effects, and contain less collinearity among the variables in the model. In this chapter, the spatial panel estimations use the developments made by Elhorst (2010a). He shows that maximum likelihood estimations of spatial panel models with fixed effects can be carried out after demeaning the variables in the model in order to control for the space-specific and time fixed effects.¹⁸

It is important to note that there are competing alternatives to estimate impacts of a given policy. For instance, instrumental variables and propensity score matching with difference estimators are popular alternatives in the literature (Khandker et al., 2010; Bartik e Bingham, 1995). Nevertheless, as in the fixed-effect model estimated in this chapter, these strategies are also based on the assumptions of conditional independence necessary to provide a causal interpretation of the estimated coefficients (Deaton 2010).¹⁹

Unlike the data of the constitutional funds described in detail in the previous section, the auxiliary data required to estimate the models presented in this section is public. The GDP per capita is retrieved from the

18. The log-likelihood functions for spatial panel data and the demeaning process to remove time and space (individual) fixed effects are detailed in Elhorst (2010a). Importantly, the spatial econometrics literature has shown that OLS estimation is inappropriate for models incorporating spatial effects. In the SEM specification, parameters' estimation will be unbiased, but inefficient due to the non-spherical structure of the disturbance variance matrix. The OLS estimator will be biased and inconsistent for the parameters of the SAR model due to the simultaneity in the nature of the spatial autocorrelation process caused by the introduction of the spatial lag.

19. Also, Angrist and Pischke (2009: 69) argue that "since the core assumption underlying causal inference is the same for the two strategies, it's worth asking whether or to what extent matching really differs from regression. Our view is that regression can be motivated as a particular sort of weighted matching estimator, and therefore the differences between regression and matching estimates are unlikely to be of major empirical importance".



National Statistics Office (IBGE), the average years of schooling of workers is calculated from RAIS (Brazilian Annual Report of Social Information of the Ministry of Labour) following Cravo (2010, 2014) and population density was taken from IPEADATA (www.ipeadata.gov.br).

4.4. EMPIRICAL RESULTS

This section presents the results for the panel estimations at micro and municipality regional level. The existing literature provides evidence on the impact of constitutional funds, however, there are no studies considering its impact on growth with spatial spillovers in a panel data setting for Brazil for different geographical scales to account for the MAUP. Thus, the evidence considering this dimension in the context of a developing country might add to the understanding of how regional policy might influence economic growth.

Table 4.3 shows the Pooled Ordinary Least Square (OLS) and Least Square Dummy Variables (LSDV) estimations at municipality and micro-regional level. The first four columns show the results for municipalities and the Pooled OLS regression provides a first indication that FNE and FCO affects growth positively as FNO does not have any positive relationship with regional growth. The consideration of non-observable municipality fixed-effect in the LSDV estimation indicate a positive effect of FNE and FCO in the estimation presented in column 3, that does not control for time fixed effects. The inclusion of time fixed effect in column 4 makes the effect of FNE on growth insignificant, a result also found in Resende (2014b). The difference in results that emerges after the inclusion of time dummies can be related to the fact that that FNE might be

associated to year-specific shocks.²⁰ Interestingly, the magnitude of FCO reduced after controlling for time-specific effects but the positive effect remained significant, suggesting that the effect of FCO on growth is less associated to shocks over time. The estimates also suggest an inverse relationship between FNO and economic growth.

The results for micro-regions (columns 9 to 16) show that the effect of the constitutional funds on growth is not stable in the regressions for micro-regions either. For instance, OLS regression shows a positive correlation between FNE and regional growth. Nevertheless, this effect fades away with the inclusion of region and time dummies, suggesting that the effect of FNE might be related to the spatial structure and specific characteristics of micro-regions and with time shocks and in the case of municipalities. In addition, panel data estimations at micro-regional level suggest that FNO and FCO have no positive impact at this broader regional scale.

Nevertheless, the literature in Brazil shows that regional growth is intrinsically dependent on space and the Moran's I in Section 3 showed that the relative importance of constitutional funds present a positive association between the original variable and its spatially lagged version. We therefore verified if the error term of the non-spatial regressions is spatially autocorrelated. The Moran's I for the residuals of the estimations are reported at the bottom of Table 4.3.²¹ The results show the presence of a significant spatial dependence in the error term at both spatial

20. For instance, shocks that affect GDP in specific years increase resources available for FNE. In a regression without time dummies, this effect is captured by the FNE variable. However, the inclusion of time dummies might also capture these effects if FNE is correlated to year-specific shocks.

21. The spatial weights used in all spatial regressions is the row-standardised inverse squared distance. The results presented in this report might differ if we impose a different spatial restriction.

scales. Interestingly, the inclusion of an area specific dummy in the LSDV estimations reduce the spatial dependence, a sign that the influence of the constitutional funds is greater inside municipalities and micro-regions.

The regressions considering the types of constitutional fund loans are presented in columns 5 and 8 for municipalities and 13 and 16 for micro-regions. The Moran's I for the residuals also indicate spatial dependence and as in the case that does not consider the different types of loans, the inclusion of an area specific dummy reduces the spatial dependence, a sign that the influence of the constitutional funds is greater inside municipalities and micro-regions. The results for municipalities show that OLS and LSDV regressions without time dummies suggest a positive effect of FNE agriculture and service and commerce on growth, however, the inclusion of time fixed effect in columns 6 and 8 make the effect of these modalities of FNE on growth insignificant. The modality of the FNO aimed at manufacturing showed positive results only in the OLS estimation (column 6). However, the LSDV estimates were not significant and indicate that this modality of FNO might be associated to individual characteristics of the municipalities; the results for the modality FNE manufacturing at micro-regional level also suggest this association at this geographic scale.

Table 3 – Impact of Constitutional Funds on GDP per capita Growth at Municipality and Micro-region Level (Pooled OLS and LSDV)

	Municipalities								Micro-regions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Pooled OLS	Pooled OLS	LSDV	LSDV	Pooled OLS	Pooled OLS	LSDV	LSDV	Pooled OLS	Pooled OLS	LSDV	LSDV	Pooled OLS	Pooled OLS	LSDV	LSDV
FNE	0.0471*** (2.71)	0.0352** (2.02)	0.0608*** (3.08)	0.0183 (1.45)					0.0494*** (8.13)	0.0530*** (9.09)	0.0141 (1.60)	0.00951 (1.32)				
FNO	0.0154 (0.23)	0.0424 (0.65)	-0.469*** (-4.16)	-0.408*** (-4.09)					0.0315 (0.13)	0.0999 (0.44)	-0.887* (-1.67)	-0.871** (-2.17)				
FCO	0.252*** (2.89)	0.253*** (3.09)	0.248** (2.46)	0.0776* (1.69)					0.174 (0.81)	0.206 (1.05)	0.392 (1.41)	-0.194 (-0.69)				
Ln(GDPpc) _{t-1}	-0.0400*** (-17.20)	-0.0412*** (-17.85)	-0.398*** (-31.80)	-0.558*** (-25.53)	-0.0409*** (-17.31)	-0.0422*** (-17.99)	-0.399*** (-31.23)	-0.558*** (-26.21)	-0.0276*** (-5.26)	-0.0275*** (-5.50)	-0.460*** (-15.87)	-0.553*** (-16.76)	-0.0275*** (-5.14)	-0.0279*** (-5.42)	-0.462*** (-15.83)	-0.554*** (-16.84)
Ln(School)	0.0116** (2.46)	0.000312 (0.06)	0.172*** (10.66)	-0.00296 (-0.30)	0.0124*** (2.65)	0.00121 (0.24)	0.169*** (10.60)	-0.00253 (-0.26)	0.0417*** (2.83)	0.0267* (1.71)	0.486*** (9.08)	-0.0650 (-1.38)	0.0448*** (3.01)	0.0273* (3.01)	0.463*** (8.47)	-0.0681 (-1.41)
Ln(Dens)	0.000429 (0.56)	0.000491 (0.65)	0.0587*** (3.96)	-0.145*** (-6.80)	0.000719 (0.92)	0.000689 (0.89)	0.0564*** (3.72)	-0.146*** (-6.98)	0.00160 (0.93)	0.00192 (1.17)	0.142* (1.87)	-0.102 (-1.11)	0.00178 (1.00)	0.00191 (1.12)	0.157** (2.12)	-0.0909 (-1.01)
FNE-Agr					0.0925* (1.69)	0.0344 (0.64)	0.151** (2.29)	0.0440 (1.10)					-0.0275*** (-5.14)	0.00276 (0.01)	0.154 (1.09)	-0.0758 (-0.62)
FNE-Manuf.					0.0143 (1.05)	0.0257** (2.02)	0.00706 (0.32)	0.0252 (1.16)					0.0448*** (3.01)	0.0682* (1.73)	0.00545 (0.12)	0.0181 (0.48)
FNE-Serv.					0.421* (1.79)	0.337 (1.39)	1.908*** (3.43)	0.424 (1.43)					0.00178 (1.00)	-0.332 (-0.86)	0.604 (0.58)	-0.168 (-0.38)
FNO-Agr					0.0211 (0.33)	0.0479 (0.78)	-0.560*** (-5.39)	-0.453*** (-4.59)					-0.0275*** (-5.14)	-0.129 (-0.52)	-1.858*** (-3.26)	-1.584*** (-4.43)
FNO-Manuf.					0.800*** (8.34)	0.738*** (7.03)	0.834*** (7.14)	0.527*** (4.46)					0.0448*** (3.01)	1.506*** (3.48)	0.874 (1.33)	0.578 (0.77)
FNO-Serv.					-0.987*** (-5.55)	-1.052*** (-5.84)	-0.681*** (-2.75)	-0.817*** (-8.27)					0.00178 (1.00)	-0.591 (-0.38)	1.402 (0.65)	0.501 (0.42)
FCO-Rural					0.506*** (4.87)	0.478*** (4.78)	0.613*** (2.74)	-0.0330 (-0.20)					-0.0275*** (-5.14)	0.0909 (0.36)	0.723* (1.68)	-0.233 (-0.62)
FCO-Bus					0.0794** (1.96)	0.0954** (2.45)	0.125** (2.13)	0.115*** (4.27)					0.0448*** (3.01)	0.374 (0.74)	0.0933 (0.24)	-0.140 (-0.32)
dummy2006		0.0403*** (15.99)		0.0672*** (30.88)		0.0400*** (15.53)		0.0668*** (31.02)		0.0436*** (8.12)		0.0742*** (13.39)		0.0437*** (7.60)		0.0734*** (12.90)
dummy2008		0.0167*** (7.29)		0.115*** (24.22)		0.0162*** (7.03)		0.115*** (25.85)		0.00749 (1.46)		0.116*** (10.43)		0.00866 (1.60)		0.116*** (10.32)
Obs.	8511	8511	8511	8511	8511	8511	8511	8511	972	972	972	972	972	972	972	972
Adj. R ²	0.078	0.110	0.419	0.568	0.082	0.113	0.424	0.569	0.078	0.155	0.533	0.651	0.074	0.148	0.54	0.654
I(2004)		0.121***		0.058***		0.123***		0.058***		0.138***		0.056***		0.132***		0.048***
I(2006)		0.125***		0.098***		0.123***		0.096***		0.146***		0.068***		0.146***		0.059***
I(2008)		0.123***		0.078***		0.120***		0.079***		0.041***		0.055***		0.038**		0.062***

Note: * p-value<0.10, ** p-value<0.05, *** p-value<0.01. Numbers in brackets for the coefficients are the *t*-statistics.

The breakdown of FNO in different types shows a significant positive impact of FNO manufacturing on growth at municipality level even after controlling for time and area fixed effect. The segmentation of FCO indicates that the positive total effect of this fund on growth at municipality level (columns 1 to 4) is likely to be driven by the modality FCO business (columns 5 to 8). Also, the LSDV estimations at micro-regional level indicate that there is no positive relationship between the FCO modalities and regional growth. These findings for the constitutional fund of the center-west are in line with Resende et al. (2014).

Nevertheless, regression results obtained from estimating the non-spatial models indicate that the model suffers from spatial dependence, since the Moran's I tests are statistically significant. This confirms the presence of spatial dependence in the error term, indicating that OLS regressions will be biased and suggesting that spatial econometrics models are likely to be more appropriate to assess the impact of constitutional funds on regional economic growth.²²

Table 4.4 shows the results of the three spatial models presented in Section 4. All spatial models suggest significant spatial correlation evidenced by the estimated parameters ρ (SAR and SDM models) and λ (SEM model). Nevertheless, the SDM model provides a more complete assessment of the spatial effects as it is the only specification that sheds light on how spatial effects work through dependent and independent variables. Also, as argued by Lesage and Fisher (2008), Lesage and Pace (2009) and Elhorst (2010b), the SDM model is preferred from a statistical point of view as the model accommodates

better the plausibility of spatial dependence in the disturbances of an OLS regression, and endogeneity in the form of an omitted explanatory variable (that follows a spatial autoregressive process) that exhibits non-zero covariance with the variables in the model.

The results from the SDM estimation at municipality level is in line with fixed-effect estimations and show that only FCO affects regional growth positively. Nevertheless, the FCO in neighboring regions are negatively related to growth. This might be related to the fact that neighbouring municipalities that have more access to the resources of the constitutional fund attract more investment and human capital from the vicinity, leading to a perverse effect on their GDP per capita. Also, constitutional funds appear to have an inverse relation with economic growth in the north of Brazil, evidenced by the coefficient of FNO in the three spatial specifications. Finally, the SAR model suggests a positive effect of FNE on growth; nevertheless, this result is not confirmed by the SEM and SDM estimations.

22. The spatial weights used in all spatial regressions is the row-standardised inverse squared distance. The results presented in this report might differ if we impose a different spatial restriction.

Table 4.4 – Impact of Constitutional Funds on GDP per capita Growth at Municipality and Micro-region Level (Spatial Regressions)

	Municipalities			Micro-regions		
	(1)	(2)	(3)	(1)	(2)	(3)
Main	SAR	SEM	SDM	SAR	SEM	SDM
FNE	0.0217* (1.78)	0.0158 (1.37)	0.0186 (1.57)	0.0142** (2.02)	0.0101 (1.43)	0.0104 (1.52)
FNO	-0.321*** (-3.20)	-0.334*** (-3.08)	-0.313*** (-2.85)	-0.801** (-2.07)	-0.836** (-2.02)	-0.783* (-1.96)
FCO	0.0554 (1.08)	0.0928* (1.90)	0.0871* (1.75)	-0.296 (-1.05)	-0.151 (-0.49)	-0.134 (-0.39)
Ln(GDPpc) _{t-1}	-0.518*** (-25.20)	-0.539*** (-22.52)	-0.532*** (-21.71)	-0.527*** (-16.79)	-0.541*** (-16.07)	-0.533*** (-16.27)
Lnesc	-0.00122 (-0.13)	-0.00204 (-0.22)	-0.00234 (-0.24)	-0.0556 (-1.21)	-0.0605 (-1.31)	-0.0614 (-1.28)
lndenspop	-0.120*** (-6.08)	-0.132*** (-5.84)	-0.126*** (-5.46)	-0.0937 (-1.02)	-0.0798 (-0.85)	-0.0684 (-0.73)
ρ or λ	0.449*** (14.60)	0.690*** (20.35)	0.660*** (16.35)	0.294*** (4.92)	0.419*** (4.86)	0.375*** (3.83)
Wx (spatially lagged variables)						
FNE			0.127 (1.22)			0.0775 (0.14)
FNO			-0.0682 (-0.20)			-0.0736 (-0.05)
FCO			-0.314* (-1.71)			-0.700 (-0.82)
Ln(GDPpc) _{t-1}			0.239*** (4.18)			0.0664 (0.69)
lnesc			-0.0165 (-0.47)			-0.0372 (-0.21)
lndenspop			0.0166 (0.31)			-0.369* (-1.74)
N	8511	8511	8511	972	972	972

Note: The Wald test suggest the use of the SDM model. * p-value<0.10, ** p-value<0.05, *** p-value<0.01. Numbers in brackets for the coefficients are the t-statistics. Time dummies were included in all regressions.

The results for micro-regional level also present significant spatial correlation but of lesser intensity when compared with results at municipality level. The estimated parameter ρ at municipality level suggests that per capita GDP growth changes by 0.66 percentage points in association with an additional one percentage point increase in the per capita GDP growth of neighbouring municipalities. In comparison, regional growth changes by 0.37 percentage points due to one percentage point increase in the per capita GDP growth of neighboring regions. The SDM results at micro-regional level also support the result from the LSDV. The regression coefficients suggest that constitutional funds are not positively correlated to regional growth in the northeast and center-west regions and that FNO has an inverse relationship with regional growth. As in the estimations for municipalities, the SAR estimation provides a weak indication that FNE affects regional growth.

Finally, the estimates presented in Table 4.5 allow us to further investigate whether different types of constitutional funds have different impacts on regional growth. The SAR estimation suggests the positive overall impact of FNE on municipal growth observed in Table 4.4 is probably because of the influence of FNE commerce and services.

The SDM results confirm that spatial correlation is stronger at municipality level. Also, economic growth is not influenced by different types of constitutional funds in neighbouring municipalities and micro-regions alike. Interestingly, the segmentation of disbursement of FNO show that this constitutional fund affects municipal growth only in its manufacturing modality. On the contrary, FNO resources allocated to agriculture or commerce and services, present a negative result on regional growth. Thus, the positive overall impact of FNO on

municipal growth observed in Table 4.4 is probably due to the influence of FNO manufacturing. At micro-regional level, FNO does not positively correlate with economic growth. Similarly, the positive overall impact of FCO on municipal growth observed in Table 4.4 is probably driven by a specific modality of the fund, as only the coefficient of FCO business is positive and significant. At micro-regional level, FCO does not correlate with economic growth.

The segmentation of the FNO data uncovers some interesting results. The breakdown of FNO indicates that its manufacturing modality is positively related to economic growth at municipal level. On the other hand, the agriculture and commerce and services modalities are negatively related to growth. The overall impact of FNO reported in Table 4.4 was negative, but this was probably the effect of FNO agriculture and commerce and services modalities driving this result. Therefore, the use of the new data on the constitutional funds that allow us to analyse different modalities of these funds are very important to uncover relationships that would not be observed with the aggregated data.

Table 4.5 – Impact of Different Types of Constitutional Funds on GDP per capita Growth at Municipality and Micro-region Level (Spatial Regressions)

	Micro-regions			Municipalities		
	(1) SAR	(2) SEM	(3) SDM	(1) SAR	(2) SEM	(3) SDM
Main						
FNE-agr.	0.0278 (0.24)	-0.0457 (-0.37)	0.00397 (0.03)	0.0592 (1.43)	0.0396 (1.03)	0.0459 (1.14)
FNE-manuf.	0.0151 (0.45)	0.0197 (0.58)	0.0161 (0.48)	0.0216 (1.00)	0.0215 (1.14)	0.0220 (1.11)
FNE-Serv&Com	-0.117 (-0.26)	-0.187 (-0.46)	-0.204 (-0.48)	0.488* (1.70)	0.344 (1.28)	0.400 (1.48)
FNO-agr	-1.423*** (-3.80)	-1.543*** (-3.82)	-1.471*** (-3.46)	-0.342*** (-3.31)	-0.363*** (-3.25)	-0.338*** (-2.93)
FNO-manuf	0.467 (0.60)	0.526 (0.71)	0.497 (0.65)	0.466*** (3.60)	0.437*** (3.65)	0.441*** (3.46)
FNO-serv&com	0.360 (0.28)	0.0769 (0.07)	-0.106 (-0.10)	-0.817*** (-9.62)	-0.844*** (-12.55)	-0.823*** (-11.87)
FCO-rural	-0.422 (-1.16)	-0.179 (-0.45)	-0.104 (-0.22)	-0.143 (-0.91)	-0.0671 (-0.33)	-0.0711 (-0.32)
FCO-Business	-0.139 (-0.31)	-0.111 (-0.25)	-0.0178 (-0.04)	0.122*** (4.57)	0.136*** (3.79)	0.129*** (3.98)
Ln(GDPpc) _{t-1}	-0.530*** (-16.99)	-0.544*** (-16.29)	-0.537*** (-16.58)	-0.518*** (-25.90)	-0.539*** (-23.10)	-0.532*** (-22.26)
lnesc	-0.0601 (-1.29)	-0.0658 (-1.40)	-0.0640 (-1.36)	-0.000835 (-0.09)	-0.00161 (-0.17)	-0.00172 (-0.18)
Indenspop	-0.0836 (-0.93)	-0.0708 (-0.77)	-0.0685 (-0.76)	-0.122*** (-6.29)	-0.133*** (-6.01)	-0.127*** (-5.60)
ρ or λ	0.277*** (4.59)	0.407*** (4.93)	0.377*** (4.26)	0.451*** (14.43)	0.689*** (20.76)	0.660*** (16.39)
Wx (spatially lagged variables)						
FNE-agr.			-0.215 (-0.22)			0.171 (1.13)
FNE-manuf.			-0.0870 (-0.13)			0.0224 (0.14)
FNE-Serv&Com			0.526 (0.33)			3.197 (1.62)
FNO-agr			1.441 (0.65)			-0.0201 (-0.06)
FNO-manuf			-0.538 (-0.29)			0.367 (0.28)
FNO-serv&com			7.449 (1.09)			2.504 (0.58)
FCO-rural			-1.235 (-0.80)			-0.0374 (-0.07)
FCO-Business			0.172 (0.09)			-0.329 (-1.20)
Ln(GDPpc) _{t-1}			0.0719 (0.75)			0.235*** (4.35)
lnesc			0.0348 (0.18)			-0.0124 (-0.35)
Indenspop			-0.393* (-1.81)			0.0121 (0.23)
N	972	972	972	8511	8511	8511

Note: The Wald test suggest the use of the SDM model. * p-value<0.10, ** p-value<0.05, *** p-value<0.01. Numbers in brackets for the coefficients are the t-statistics.

4.5. CONCLUSION

This chapter has analysed the importance of constitutional funds for the process of regional economic growth in Brazilian municipalities and micro-regions using spatial panel econometrics. The results show that non-spatial panel data estimations suffer from spatial dependence and more efficient estimations of the effect of constitutional funds on growth required the use of spatial panel econometrics.

The estimations evidenced significant spatial correlation in the data and confirmed previous results found in the literature that the micro-regional growth process present spatial correlation of lesser intensity when compared with results at municipality level. Regressions using the total amount that encompasses all modalities of constitutional funds showed that only FCO and FNO present some positive correlation with regional growth positively at municipality level. The SDM estimation also suggests that FCO in neighboring regions are negatively related to growth, suggesting that the positive effect of FCO is local and do not spillover across neighbouring municipalities. Conversely, FNO showed an inverse relation with economic growth in the north of Brazil. Apart from the SAR coefficient for FNE, the results at micro-regional level showed that constitutional funds do not promote regional growth in any of the regions eligible to benefit from these funds, an indication that the effect of the funds are more likely to be localized at a smaller geographic area.

The new data used in the chapter opened up the possibility to investigate the effect of different types of constitutional funds on economic growth. For instance, the breakdown of constitutional funds

showed that the positive overall impact of FCO on municipal growth is probably driven by the FCO business modality. Interestingly, the results suggest that the FNO manufacturing modality affects growth positively despite the overall inverse relation between FNO and growth.

The use of the new panel data on the constitutional funds revealed relationships that would not be observed with cross-sectional aggregated data. Further exploration of this data will produce important results that might influence the design of better guidelines to make more effective use of the constitutional funds.

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5. FINAL REMARKS

This report provided an account about the regional policies implemented in the European Union (EU) and Brazil. The first two chapters focused on the EU. Firstly, an historical account of the institutional evolution of the European Union was provided as a mean to better understand the context in which the regional policies were developed. Next, the report provided an assessment of the regional policy and its impact on economic and social cohesion across the EU member states.

The official documentation of the European Commission and the academic literature used to elaborate this report indicate that despite the efforts of the Cohesion Policies, regional asymmetries remain significant across the EU. Cohesion policies might have contributed to prevent these asymmetries to get worse but certainly were not successfully at reducing regional inequality. The report suggests that a shift from initially country-level oriented support to a more regional and local-economy based support might be an alternative strategy to improve the effectiveness of

the resources allocated to regional policies as there are specificities to local economies.

Nevertheless, an effort to strengthen monitoring and evaluation system aiming at providing more rigorous impact evaluations related to the regional policy at regional and micro level is paramount. In this context, the Directorate General for Regional and Urban Policy (DG-REGIO) produced the “Guidance Document on Monitoring and Evaluation – European Regional Development Fund and Cohesion Fund” (DG-REGIO, 2014), which suggests a movement in the DG-REGIO towards more rigorous impact evaluations of regional policies in the EU.

The combination of local impact evaluations together with assessments performed at a broader geographical area is also important as it allows academic and policy-makers to analyze the geographical reach of regional policies and whether policy interventions spillover over neighboring areas. These challenges are common to Brazil and the EU.

The third chapter presents a discussion about the goals and the evidence about the impact of regional policy in Brazil, paying particular attention to the

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evidence on the effect of constitutional funds on growth. By reviewing current academic evidence, the chapter identifies shortcomings and future challenges regarding the evaluation of regional policies in Brazil. For instance, it highlights the need of a better monitoring and evaluation framework and studies that take into account the spatial dependence and geographical reach of policy interventions.

The last chapter is the only empirical work of this report and addresses some of the key challenges pointed out in previous chapters of the document. Chapter 4 uses data for different spatial scales (municipalities and micro-regions) to analyse the impact of constitutional funds on GDP per capita growth between 2004 and 2010 using spatial panel econometrics. The results suggest that constitutional funds have some positive impact on GDP per capita growth mainly at municipality level, which is the smallest spatial scale. Furthermore, the results indicate that different modalities of FCO, FNO and FNE affect regional growth differently and the spatial estimations did not indicate the existence of spatial spillovers stemming directly from the constitutional funds.

Despite all historical, economic and social differences, the EU and Brazil are two large economies with common regional development challenges. Both economies present striking regional inequalities and use active policies as a tool to tackle this issue. This document intends to contribute to the dialog between the two economies regarding their regional policies and indicates some areas of common challenges and possible cooperation in order to improve the effectiveness of regional policies in the future.





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