Growing closer together

The effect of the EU Regional Policy Funds on convergence of the EU regions

Master Thesis Chris Bakker

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Master Thesis Wageningen University
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Abstract

The European Union (EU) tries to reduce the disparities in income between the EU regions. This is called convergence. The Regional Policy Funds are the instrument used to reach convergence. This thesis researches whether the EU succeeds in reaching convergence of EU regions through the Regional Policy Funds. This thesis adds to the existing literature in being the first to look at the budget period 2007-2013, the first budget period with 27 instead of 15 EU member states. Another feature is the use of spatial econometric techniques to take account of spatial spillover effects. The Solow model is the main theoretical model used. Following this model the investments paid by the Regional Policy Funds should lead to more production and thus to more income. Using data sent by the European Commission and from Eurostat the analysis shows that poor EU regions have higher economic growth than rich EU regions in the budget period 2007-2013, so convergence is taking place. The Regional Policy Funds did however not lead to higher economic growth of EU regions. In contrast with literature about the previous budget periods the Regional Policy Funds do thus not succeed in reaching convergence of EU regions in the budget period 2007-2013.

Source picture front page: Freeman (2014)

Preface

I find the European Union a fascinating institution. Started as a peace project the European Union has now become a big organization under fire. The current refugee crisis shows that European integration is not a fait accompli. Several countries do not want to house refugees and close their borders. In these restless times it is interesting to research a EU project that is meant to promote European integration.

This master thesis about the EU Regional Policy Funds is the concluding piece of my master in Management, Economics and Consumer Studies. My specialization in this master is Agricultural Economics and Rural Policy. In this field the European Union is an institution of major importance. Both the Common Agricultural Policy and Regional Policy Funds are major programs of the EU. As I am always interested in policy results, I am glad I was able to research the effectiveness of one of the two programs in this thesis.

Several people were of great help in writing this thesis. The help of my supervisor Rico Ihle, assistant professor at the Agricultural Economics and Rural Policy Group of Wageningen University, was of major importance. He helped me with sharp feedback and fresh ideas. I think it is rare that a thesis supervisor wants to schedule two hours for a thesis discussion, so I was very lucky with Rico as supervisor. Dadan Wardhana, PhD student in the same department as Rico Ihle, was of great help in getting started with ArcGIS. I would also like to thank Thomas de Graaff and Hans Koster, both assistant professor in Spatial Economics at the Vrije Universiteit in Amsterdam. They helped me in getting used to the theory behind spatial econometrics and working with spatial econometrics in STATA. Finally, I thank Jack Peerlings, associate professor in the same department as Rico Ihle, for being the second reader of this thesis.

This thesis is the last act of a long study time that started at the University of Amsterdam, continued at the Vrije Universiteit and finished at Wageningen University. All three universities have their own qualities and atmosphere. It was great joy studying at these universities. There is no such thing as a free lunch, so I thank the Dutch tax payer for supporting my studies. Most of all I however want to thank my parents for their financial support and, even more important, their moral support. I am looking forward to start as trainee at Rabobank in March, the employer of my father for years.

'De appel valt niet ver van de boom'.

Chris Bakker

January 2015

Table of content

List of abbreviations, figures and tables

Figure or table number starting with A indicates figure or table included as appendix.

Abbreviations

AIC: Akeike information criterion

EC: European Community

EU: European Union

ERDF: European Regional Development Fund

ESF: European Social Fund

GDP: gross domestic product

NUTS: Nomenclature des Unités Territoriales Statistiques

OECD: Organisation for Economic Co-operation and Development

PPS: purchasing power standard

R&D: research and development

QGI: Quality of Governance Institute

UK: United Kingdom

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1. Introduction

1.1. Motivation and relevance

Policy evaluation has important purposes. A policy evaluation shows to what extent progress is made as a result of the policy. Policy evaluation also provides essential information for making good new policy. This information helps to create political support for new policy (OECD 2014). This thesis focuses on the evaluation of the Regional Policy of the European Union (EU). The current Regional Policy is the result of long series of negotiations since the start of the European Community in 1957. The Regional Policy Funds are worth approximately one third of the EU budget. For the budget period 2007-2013 the budget for the Regional Policy Funds is 347 billion euros, more than the GDP of Slovenia over the same period (EU Regional Policy 2015). These euros are meant to reduce the disparities in income between the regions of the EU. The societal relevance of this thesis is to check whether the EU succeeds in increasing economic cohesion through the Regional Policy Funds. The findings of this thesis help policymakers to improve the policy. Better policy helps poorer regions to develop quicker and better, of which their citizens profit.

The Regional Policy Funds are already much debated in scientific literature. This literature however focuses on the EU member states before 2004. The 2004 and 2007 extension of the EU with ten eastern European countries has not received attention until now. The scientific relevance of this thesis is trying to fill this gap. The thesis also adds to the existing literature in making use of several variations of a spatial weight matrix. Several articles use the spatial weight matrix to control for geographical proximity between regions. The matrix can however also be defined for other types of proximity between regions, for example their similarity in institutional quality or similarity in extent of internet access.

1.2. Objective and research questions

The objective of the thesis is to determine if the Regional Policy Funds in the budget period 2007-2013 have led to convergence of the EU NUTS-II regions. The main research question is therefore as follows: 'To what extent did the Regional Policy Funds in the budget period 2007-2013 lead to convergence of EU NUTS-II regions?'. A poor region converges if its gross domestic product per inhabitant, in purchasing power standard, grows faster than the EU average. NUTS-II is a statistical division of the European regions. The Netherlands has for example twelve NUTS-II regions, being equal to the twelve Dutch provinces. In the budget period 2007-2013 the EU had in total 272 NUTS-II regions.

The thesis has three sub-research questions. The first question focuses on the what of the topic: 'What are the Regional Policy Funds and what is the economic reasoning behind them?'. The second question is about the work done on the topic before: 'To what extent have the Regional Policy Funds shown to

be effective in causing convergence of EU NUTS-II regions?'. The last question is: 'To what extent does proximity between regions influence their extent of convergence?'. Regions that are geographically close or are politically or culturally similar might converge more than regions that are not.

1.3. Theory

In most convergence literature the neoclassical growth model of Solow (1956) is the benchmark model. This model assumes that countries with the same rate of savings, depreciation and population growth as well as having access to the same technology will finally converge. Mankiw et al. (1990) adds human capital to this model. The Solow neoclassical growth model contrasts with the core-periphery model of Krugman (1990). This model assumes that some economic forces promote agglomeration of economic activity. Other economic forces lead to dispersion of economic activity. Economic integration can therefore lead to both convergence and divergence, depending on which forces are stronger.

With the Regional Policy Funds the EU supports productive public investments, like infrastructure. The idea behind the Funds is that the investments lead to more production and therefore to more economic growth of the region. The effect of the Regional Policy Funds depends on whether the effect of the investments is permanent or temporary. Another important issue is whether the Regional Policy Funds do substitute national funds. If this is the case, Regional Policy Funds will have less effect than expected (Ederveen et al. 2002). The first hypothesis of this thesis is that Regional Policy Funds have a positive effect on the economic growth of regions. As most Regional Policy Funds are aimed at relatively poor regions, the second hypothesis is that Regional Policy Funds lead to convergence of EU regions.

Regional Policy Funds for projects in one region might also affect the economic growth in a surrounding region. An investment in a highway in an eastern region of the Czech Republic might for example also affect other Czech regions or regions in Poland or Slovakia by easing transport between regions. This is called a spatial spillover effect. Spatial spillover effects need to be taken into account to achieve a proper analysis of the effectiveness of the Regional Policy Funds.

1.4. Methods and data

The model used in the thesis is a variation on the neoclassical growth model of Solow with the share of employment in agriculture (Dall'erba and Le Gallo 2008), long term unemployment and population density (Cappelen et al. 2003) included as control variables. A spatial weight matrix will be used to take account of spatial spillover effects. A spatial weight matrix shows how regions are related to each other in space. A spatial weight matrix normally shows the geographical distances between regions. Also a adjacency matrix, showing which regions share a border, is commonly used. Spatial weight matrices can however also be used to quantify other kinds of proximity. In this thesis spatial weight matrices

are made for the differences in institutional quality between regions (measured by an index number) and the differences in extent of internet access between regions. In total four different spatial weight matrices are thus used in this thesis. It is important that the information in a matrix is not correlated with the Regional Policy Funds to prevent issues of endogeneity. The European Commission sent a document with the allocated Regional Policy Funds for the budget period 2007-2013 per NUTS-II region. Most other data come from Eurostat, the statistical bureau of the EU.

1.5. Structure

Next chapter discusses the history of the Regional Policy Funds, the Regional Policy Funds in the period 2007-2013 and the theoretical background of the Regional Policy Funds. This chapter answers the first sub-research question 'What are the Regional Policy Funds and what is the economic reasoning behind them?'. The third chapter summarizes the research done on the effectiveness of the Regional Policy Funds. This chapter thus answers the second sub-research question 'To what extent have the Regional Policy Funds shown to be effective in causing convergence of EU NUTS-II regions?'. The fourth chapter is the main part of the thesis. This chapter includes the data sources, a descriptive analysis of the data, the methods used, the results and the discussion of the results. The fourth chapter thus answers the third sub-research question: 'To what extent does proximity between regions influence their extent of convergence?'. The fifth chapter concludes.

2. Regional Policy Funds and their theoretical background

´The Community shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions or islands, including rural areas´. This quote comes from Article 158 of the Treaty of Rome, the 1957 founding document of the European Community (EC). Convergence is thus a goal of the European Union (EU) from the early days of the EU onwards. Regional Policy grows from then on to become one of the most important policy areas of the EU. The EU nowadays spends one third of its budget on Regional Policy. The development of the EU Regional Policy over the decades and its content in the budget period 2007-2013 are discussed in the first two sections. A discussion of the concept of convergence and the models used as theoretical background ends this chapter.

2.1. History EU Regional Policy Funds

In the first years of the EC there are no substantial instruments to achieve convergence. Only the European Social Fund (ESF) is established to promote employment possibilities. Substantial attention to Regional Policy comes in 1973. That year the United Kingdom (UK) joins the EC, together with Denmark and Ireland. The UK does not expect many benefits from the Common Agricultural Policy. To make sure the UK will also financially benefit from the EC the European Regional Development Fund (ERDF) is established in 1975. The ERDF has the goal to increase social and economic cohesion in the EC by correcting imbalances between regions. The ESF and the ERDF are together called the Structural Funds. The EC leaders see the establishment of the ERDF as an important step. Converging nations and regions are namely a requirement for the long term goal of establishing an European economic and monetary union.

1986 brings a substantial increase in the Structural Funds. Spain and Portugal enter the EC that year after Greece already entered in 1981. The Common Agricultural Policy does not heavily support the products these countries produce. Spain and Portugal make sure during their accession talks that the EC will spend more on poor regions. 1986 is also the year of the Single European Act, the document that establishes the European internal market. Economic integration is assumed to primarily benefit the industrial regions. Poor agricultural regions ask therefore to be compensated for the implementation of the Single European Act. A combination of the accession of Spain and Portugal and the Single European Act thus leads to an increased spending on Structural Funds.

From 1989 onwards the Structural Funds have four central guiding principles. The first principle is concentration. Structural Funds are spent in the poorest and most backward regions. Partnership is the second principle. National and regional authorities and other partners, like civil society organizations, need to be involved in implementing Regional Policy. The third principle is programming. Regional Policy does not focus on separate projects, but on broader multi-year

programs. Additionality is the fourth principle. Structural Funds do not fund what national governments can fund. Between 1989 and 1993 the yearly budget for regional policy is 14 billion ECU, the unit of account that predeceased the Euro. This is approximately 20 percent of the EC budget. The budget is mainly spent on Objective 1 regions. These are regions with a GDP per capita below 75 percent of the European average. The other objectives target areas affected by industrial decline (Objective 2), dealing with long term unemployment (3), adjusting to industrial change (4), reforming agricultural sectors (5a), being rural areas (5b) and being thinly populated areas (6).

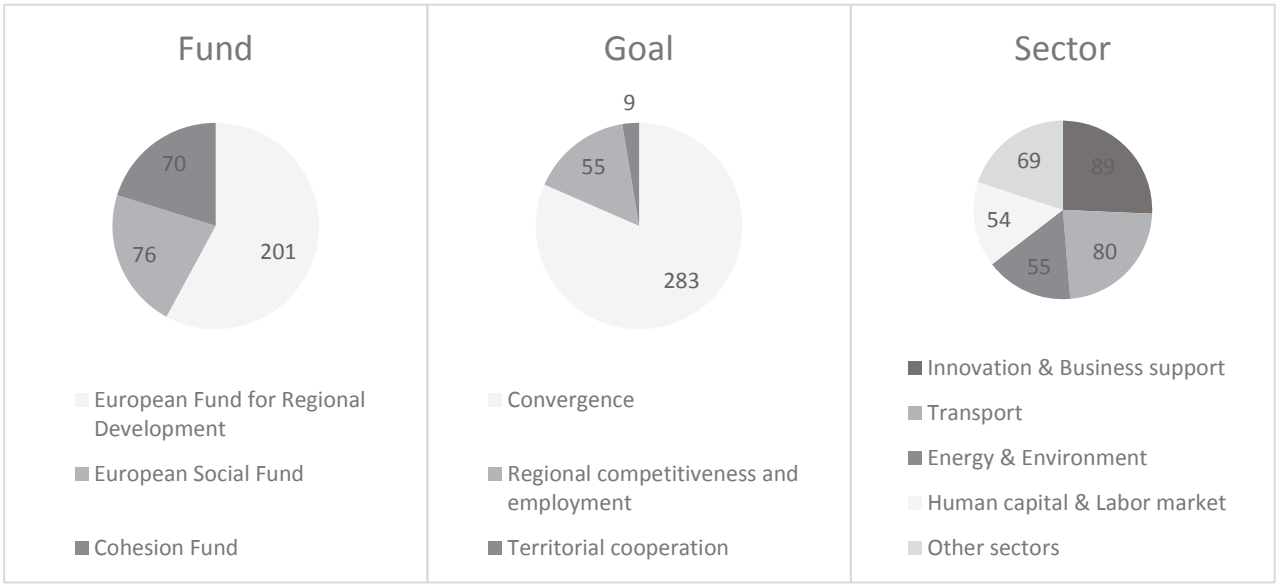
In 1992 the Maastricht Treaty adds a new fund for Regional Policy to the existing two funds (ESF and ERDF): the Cohesion Fund. This fund can only be spent in countries with a national GDP of lower than 90 percent of the EU average: Spain, Portugal, Ireland and Greece. The eligibility for funding by the Cohesion Fund is determined by the national GDP, not the regional GDP like the Structural Funds. The available budget for Regional Policy more than doubles to 32 billion ECU per year for the period 1994-1999, which is approximately 30 percent of the EU budget.

In the next period 2000-2006 the 2004 enlargement with 10 new member states attracts most attention. The amount of citizens living in regions eligible for support increases from 155 million people to 224 million people. The available budget therefore increases to 38 billion Euros per year in the budget period 2000-2006, a third of the EU budget. The six objectives before are reduced to three. The EU wants to focus more on creating jobs and stimulating innovation. The new Objective 2 is therefore helping regions with structural problems in their economic and social conversion. Objective 3 becomes stimulating training, education and employment in regions (Baldwin and Wyplosz 2012; Ederveen et al. 2006; EU Regional Policy 2015).

2.2. EU Regional Policy Funds 2007-2013

In the budget period 2007-2013 the EU aims to simplify the structure of the Regional Policy. Each region is eligible for support. Convergence of poor regions stays the primary focus of the Regional Policy. Objective 2 regions, thus all regions without an Objective 1 status, qualify for support for stimulating regional competitiveness and employment. Border regions can get support for international territorial cooperation. Romania and Bulgaria enter the EU in 2007. Also for that reason the EU budget for Regional Policy increases to 49.4 billion euro per year, 36 percent of the EU budget. For the complete period the budget is 347 billion euros (Baldwin and Wyplosz 2012; EU Regional Policy 2015). Figure 1 shows how this budget is divided over the three funds and the three goals. Most money comes from the ERDF and is meant to promote convergence. Figure 1 also shows to which sectors the budget flows. Most Regional Policy Funds are invested in innovation and transport.

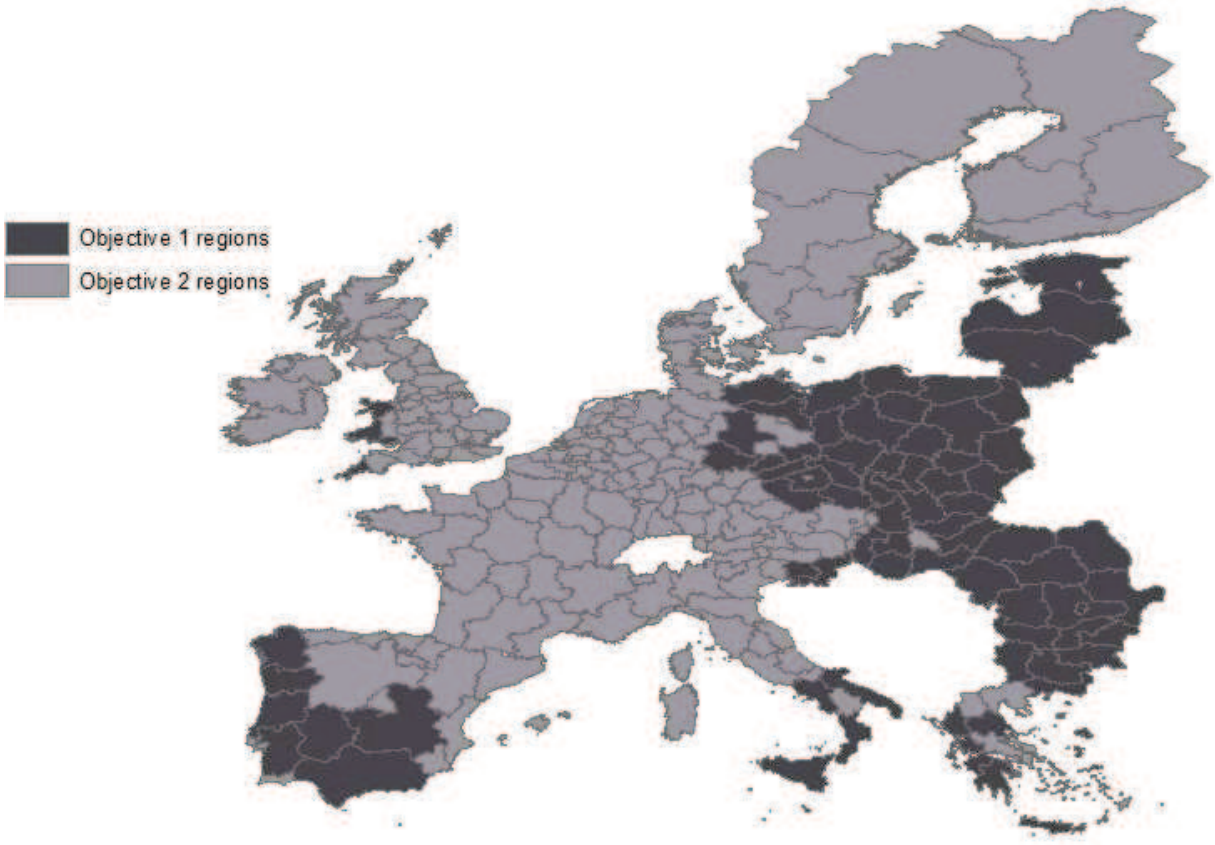
Figure 1: Division Regional Policy Funds 2007-2013 per fund, goal and sector in billion euros



Amounts per graph sum to 347 billion euros. Data source: EU Regional Policy (2015)

Figure 2 shows which regions are eligible as Objective 1 region for support of the ESF and ERDF in the period 2007-2013. The twelve member states that entered the EU in 2004 and 2007 plus Greece and Portugal are eligible for support of the Cohesion Fund. Spain receives partial support from this fund.

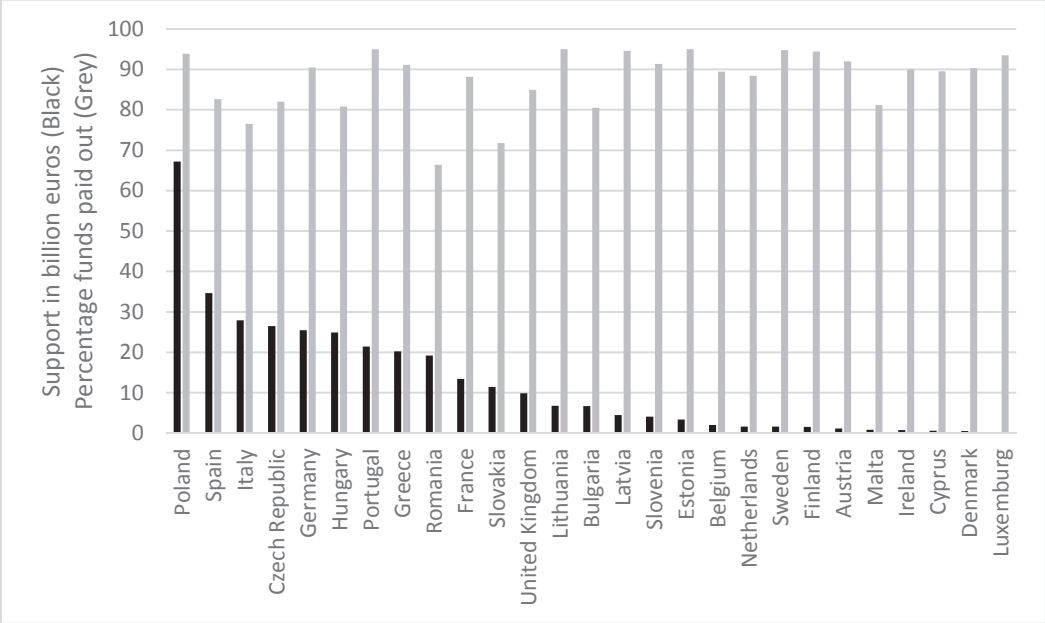
Figure 2: Objective 1 regions in Regional Policy 2007-2013



Data source: EU Regional Policy (2015)

Figure 3 shows how much support each of the 27 member states gets in the period 2007-2013. Poland is the largest receiver of the Regional Policy Funds. Figure 3 also shows which percentage of the available Funds for each country has been paid out until and including 2014. National authorities namely have to design projects in which the EU invests the allocated budget. Only after approval of the project by the EU the EU pays out the project budget. Funds can be paid out until two years after the budget period, so December 2015. For most of the countries around 90 percent of the available Funds has been paid out until and including 2014. Especially Romania and Slovakia do however lay behind (EU Regional Policy 2015).

Figure 3: Support by Regional Policy 2007-2013 and percentage of paid out Funds until and including 2014



Data source: EU Regional Policy (2015)

2.3. Theoretical background

Convergence is the 'tendency towards the reduction of income disparities' between certain entities, for example regions (Ederveen et al. 2002: 12). Convergence in the EU thus means that poorer EU regions have higher economic growth than the richer regions. Convergence can be measured in several ways (Quah 1993). Two measures for convergence are most often used: β-convergence and s-convergence (Ederveen et al. 2002). β-convergence means the existence of a negative relationship between initial GDP per capita and the growth of GDP per capita. Regions with a low initial GDP per capita thus have on average a higher growth of GDP per capita than regions with a high initial GDP per capita. β-convergence takes place if the β-coefficient is negative in the following equation:

$$gdp_{i,t} - gdp_{i,t-1} = \alpha + \beta \ln gdp_{i,t-1} + u_{i,t} \quad (1)$$

In Formula 1 $gdp_{i,t-1}$ is the initial GDP per capita in region *i* in year *t-1*. $gdp_{i,t}$ is the new GDP per capita in year *t*. $u_{i,t}$ is the error term. β-convergence can be absolute or conditional. Absolute β-convergence means that poorer regions have higher economic growth than richer regions. Conditional β-convergence means that the economy of regions will converge, if they have the same characteristics besides income. Regions with for example the same education level or level or infrastructure will thus converge to the same income level. s-convergence means the extent of dispersion of the average GDP per capita per region in a group of regions. The standard deviation of the log GDP per capita can be used as a measure (Ederveen et al. 2002). In their own research about the economic growth of EU NUTS-II regions between 1984 and 1996 Ederveen et al. (2002) show both the existence of β-convergence and s-convergence in that period.

Two models provide among other models insights into the effects of funds like the Regional Policy Funds: the Solow neoclassical growth model and the core-periphery model (Mohl and Hagen 2010). The Solow neoclassical growth model focuses on the why of the economic growth of regions, while the core-periphery model focuses on the why of the clustering of economic activity in regions. In most convergence literature the Solow model is the benchmark model (Mohl and Hagen 2010). This model assumes that countries with the same growth rate of investment, rate of depreciation and rate of population growth as well as having access to the same technology will finally converge to the same economic growth rate. Mankiw et al. (1990) add the growth rate of human capital to this model. Investment and human capital are assumed to positively impact income per capita. Population growth negatively influences income per capita (Solow 1956).

The main intuition of the Solow model is that more investments lead to more production and therefore to a higher income. The Solow model has two key equations. The first is the production function:

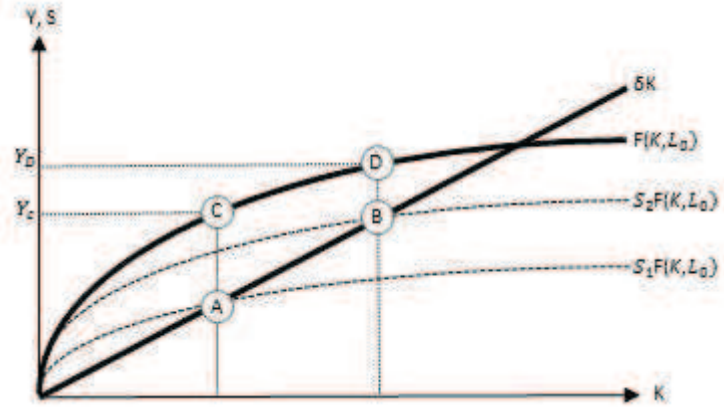
$$Y = F(K, L_0) \qquad (2)$$

The production function shows how much output Y can be produced with a varying amount of capital K and a fixed amount of labour L_0. The subscript *0* indicates that the amount of labour L does not depend on the period. The second function is the capital accumulation function:

$$\Delta K = I - \delta K \qquad (3)$$

I is the gross amount of investments. δK is the amount of capital depreciation with δ indicating the depreciation share. ΔK is the change in investments, thus the net amount of investments. Figure 4 shows the production function $F(K, L_0)$ and the capital depreciation function (δK). Figure 4 also shows the savings function $S_1 F(K, L_0)$ in period *1*. The Solow model assumes that income can be saved or consumed. The fraction of income saved is S_1 in period *1*. The savings function thus shows that a fraction S_1 of output Y is saved and therefore invested. The capital accumulation function can thus be

Figure 4: Effect of permanent increase in savings rate in Solow model



Source: own work author based on Gartner 2009: 253

written as:

$$\Delta K = S_1 F(K, L_0) - \delta K \qquad (4)$$

Net investments are thus zero at the point where savings (and thus gross investments) equal capital depreciation. This is point A in Figure 4. The production is at point C at the production function, so the output is Y_C. If gross investments equal capital depreciation the economy is said to be in steady state. In point A in Figure 4 the economy is thus in steady state. The amount of capital in steady state is called the steady state capital stock. The Solow model states that in steady state the growth rate of the economy is equal to the rate of technological progress.

The Regional Policy Funds work as gross investments in the economy. The amount of investments in the economy thus increases and so does the savings rate. The economy switches in Figure 1 from $S_1 F(K, L_0)$ in period *1* to $S_2 F(K, L_0)$ in period *2*. The new point of steady state is now point B, where savings, investments, capital and output are higher than in point A. The production is now at point D at the production function, so the new output is Y_D. The economy however does not jump instantly from A to B. The move from A to B is a dynamic process. At first the Regional Policy Funds lead to the gross investments being higher than the capital depreciation. This boosts the output of the economy temporarily. The growth level of income is thus temporarily higher than normal. More investments do however also lead to more depreciation in the next period. The returns on capital investments besides decrease, as the Solow model assumes a decreasing marginal rate of capital. The Regional Policy Funds thus boost the capital level K, but the benefits of the boost decrease over time while the costs of depreciation increase. The economy finally comes to a new steady state in point B, where $S_2 F(K, L_0)$ = δK. Savings are thus again equal to capital depreciation. The income growth rate is the same as before in point A.

The explanation above is only valid for a continuous stream of Regional Policy Funds spent on productive public investment. The Regional Policy Funds are however a temporal measure. The

investments financed by the Regional Policy Funds need to stimulate other investments. These other investments then need to create investments and so forth, so that finally the Regional Policy Funds are not needed anymore. Only in this case the effect of the Regional Policy Funds will be permanent. If however other sources of investments do not replace the Regional Policy Funds, the effect of the Regional Policy Funds on the savings rate will only be temporal. The economy will then not move to point B, but return to point A in Figure 4 again. In this case the rate of income growth will first be above the income growth level in steady state. After some periods the rate of income growth will however drop below the income growth level in steady state. This results in the economy returning to the old steady state (point A) again. Another important issue is whether the Regional Policy Funds do substitute national funds. In that case the Regional Policy Funds finance investments that would also have happened without the Regional Policy Funds. The effect of the Regional Policy Funds is then less than expected (Ederveen et al. 2002).

The neoclassical growth model contrasts with the core-periphery model of Krugman (1990). This model assumes two type of forces drive firms in the choose of their location: agglomeration forces and dispersion forces. Agglomeration forces make firms locate close to each other. Dispersion forces make firms want to locate away from the other firms. Firms want to locate close to the place where the demand is the biggest to avoid transportation costs. This area is called the core. In the European Union the area between London, Paris, Frankfurt and Amsterdam could be called the core. As more firms think this way, firms start to agglomerate. Their workers' local spending enlarges the market, which attracts other firms as well. As well as profiting from increasing demand firms also profit from increasing scale economies. If there would be no dispersion forces, the situation would end with all firms clustered in the core. An important dispersion force is however the degree of competition. In the core firms have an incentive to relocate to a market with less competition, the periphery, as less competition means more market opportunities. In the EU all Objective 1 regions belong to the periphery. Low-competitive markets in the periphery normally also have lower costs for capital and labour than high-competitive markets in the core. With the Regional Policy Funds the EU tries to attract new investments in the periphery of the EU. The EU thus tries to create a dispersion force for firms to relocate in Objective 1 regions (Baldwin and Wyplosz 2012).

Regional Policy Funds for projects in one region might also effect the economic growth in another region. An investment in a highway in an eastern region of the Czech Republic might for example also have effects on the economic growth of other regions in the Czech Republic or regions close by in Poland or Slovakia. These effects are called spatial spillover effects. Spatial spillover effects are effects in a region caused by events in a region in the proximity. Interaction between regions is thus a prerequisite for the existence of spatial spillover effects. Several types of spatial spillover effects can be distinguished. Knowledge spatial spillover effects mean that knowledge created by a firm or

institution in one region is also obtained by a firm or institution in another region. Contacts between firms can be a channel for knowledge spatial spillover effects. Industry spatial spillover effects are the influence of the productivity of a firm on the productivity of a firm in another region. This influence can be created through input linkages, output linkages or competition linkages. In a multinational firm expertise about production techniques can flow from the department in one country to a department in another country, where a supplier of the firm might also learn from this expertise. Growth spatial spillover effects are a third type of spatial spillover effects. Developments in one region influence the growth of a surrounding region through trade linkages, demand linkages and the mobility of production factors between regions. A growth in income in one region can for example cause an increase in import from another region, leading to an increase in income in that region as well (Capello 2009).

The fundamental concept behind spatial spillover effects is spatial autocorrelation. Spatial autocorrelation (or spatial dependence) means that correlation exists between phenomena happening in spatial units (e.g. regions) *i* and *j.* This correlation can be shown with in the following formula:

$$Pr(X_i = x_i) \neq Pr(X_i = x_i \mid X_j = x_j) \qquad (5)$$

This formula states that the probability that x_i occurs in spatial unit *i* is not independent from the probability that x_j occurs in spatial unit *j*. The neighbours of spatial unit *i* thus influence the phenomenon x_i in spatial unit *i*. This can also be written down with the formula:

$$Cov(X_i, X_j) = E(X_i, X_j) - E(X_i)\,E(X_j) \neq 0 \qquad (6)$$

This formula states that spatial unit *i* is spatially autocorrelated with its neighbours (Koster and de Graaf 2014). The method section (Section 4.3) discusses how to deal with spatial autocorrelation in a spatial analysis.

3. Literature review

The literature on the effectiveness of the Regional Policy Funds is quickly expanding. After every budget period of the Regional Policy Funds articles are written about the effectiveness of the Regional Policy Funds. This thesis is the first attempt to examine the effectiveness of the Regional Policy Funds in the budget period 2007-2013. The literature about the Regional Policy Funds also expands by using new regression methods. Using spatial econometric techniques, like done in this thesis, has been done in a few articles about Regional Policy Funds before. In this chapter first the literature on the effectiveness of the Regional Policy Funds is discussed. The literature on control variables used in analyses on the Funds' effectiveness before is then discussed. Last, the literature on interaction between regions is discussed.

3.1. Literature on effectiveness of Regional Policy Funds

Most literature about the effectiveness of the Regional Policy Funds focuses on the effectiveness of the Structural Funds. Mohl and Hagen (2010) give a good overview of the literature on the impact of Structural Funds on economic growth. The results of this literature are ambiguous. Some studies see a positive impact of Structural Funds. Beugelsdijk and Eijffinger (2005) conclude that between 1995 and 2002 the poorer EU countries were able to catch up with the other EU countries as a result of the Structural Funds. They also conclude that more corrupt countries do not use the Structural Funds on economic growth more inefficient than less corrupt countries. Cappelen et al. (2003) also show positive effects of the Structural Funds. The effect is the biggest in a good economic environment with for example high R&D capabilities and low unemployment. To make Structural Funds more efficient the EU should thus improve the competence of the receiving regions. Becker et al. (2010) find a positive effect of the Structural Funds for Objective 1 regions on per capita income growth, but not on employment growth.

Other studies conclude that the Structural Funds only have a positive effect under certain conditions. Ederveen et al. (2006) conclude that the Structural Funds are only effective in countries with good institutions. Rodriguez-Pose and Fratesi (2004) conclude that only investments in education and human capital have significant positive effects. The support for agriculture has only short term positive effects. The Structural Funds for business support and infrastructure do not have a significant effect. Ederveen et al. (2002) conclude that the effect of Structural Funds depends on the model specification. Assuming convergence between regions, the model results in a positive effect of the Structural Funds. Assuming only convergence of regions within countries, the model does not show a positive effect. Assuming no convergence at all, the model shows a significant negative effect of the Structural Funds.

A couple of studies finds no effect or even a negative effect of Structural Funds. Akcomak and Ter Weel (2007) find no significant effect of the Structural Funds on regional economic growth. They also find

that regions with more social capital gain more from the Structural Funds than regions with less social capital. Fagerberg and Verspagen (1996) find that the Structural Funds negatively influence the rate of convergence between the European regions.

The studies using spatial econometric techniques also show different results. Dall'Erba (2005) uses an exploratory spatial data analysis. She first shows the existence of spatial autocorrelation among the per capita incomes of EU regions. A significant core-periphery pattern exists. She then finds a positive relationship between the Structural Funds and regional economic growth. Dall'Erba and Le Gallo (2008) use a spatial lag model with instrumental variables. They conclude that significant convergence between regions takes place. The Structural Funds do however not influence this process. Ramajo et al. (2008) use a spatial lag model. They find a faster conditional convergence of relative income levels in countries that receive Regional Policy Funds than in countries that do not. Dall'Erba et al. (2009) find a small significant negative effect of the Structural Funds on regional economic growth. The conclusion is the same for the Structural Funds for Objective 1 regions, while the Structural Funds for Objective 2 regions do not have a significant effect. Mohl and Hagen (2010) also use a spatial lag model. They find that payments in Objective 1 regions promote economic growth. Payments in all EU regions combined do however not have a significant positive impact on the economic growth of EU regions.

Some literature has been published on the effect of the Regional Policy Funds after Mohl and Hagen (2010), as also shown in Table 1. Le Gallo et al. (2011) research the local impact on different regions of the Structural Funds. They find that the global impact on economic growth of the Structural Funds is weak. Local effects however differ. A positive significant effect of Structural Funds is found for British, Greek and southern Italian regions. A negative significant effect is found for Dutch, Belgium and some French and German regions. Becker et al. (2012) find that Regional Policy Funds foster regional economic growth, but some reallocation of the Funds would generate an even bigger effect. Becker et al. (2013) find that only thirty percent of the Objective 1 regions is able to realize more economic

Table 1: Overview recent literature on effect Regional Policy Funds on economic growth

Paper by	Impact of Funds on economic growth	Operationalisation of Funds	Time period	Units	Econometric methods
Bouayad-Agha et al. (2013)	Significant positive effect for Objective 1 regions, no effect for total Structural Funds	Structural Funds per capita	1980-2005	143 NUTS-I/ NUTS-II regions	Spatial dynamic panel data analysis
Becker et al. (2013)	Only 30 percent of Structural Funds is able to create more economic growth	Dummy variable: 1 if Objective 1 region, 0 if not	1989-1993 1994-1999 2000-2006	186-251 NUTS-II regions per period	Regression discontinuity design with hetero-geneous treatment effects
Becker et al. (2012)	Funds foster economic growth, but reallocation of Funds would increase effect	Dummy variable: 1 if Objective 1 region, 0 if not	1994-1999 2000-2006	285 NUTS-II regions and 1213 NUTS-III	Regression discontinuity with general propensity score design
Le Gallo et al. (2011)	Global impact Structural Funds on economic growth weak, but local effects differ	Structural Funds as % of GDP	1989-1999	145 NUTS-II Regions	Bayesian locally linear spatial estimation method

Source: own work author

growth through the Funds. Only twenty percent of the Objective 1 regions are able to use the Funds to generate more investments. Bouayad-Agha et al. (2013) find a significant positive effect of Objective 1 programmes on regional economic growth. Total Structural Funds do however not have an effect on regional economic growth.

3.2. Literature on control variables

Several in the literature used control variables affect the effectiveness of Structural Funds. Olejnik (2008) uses a dummy for new countries to take factors into account that may influence economic growth and differ between the new and old member states. In the regression the dummy shows a significant negative coefficient. The income growth induced by the Structural Funds is thus bigger in regions in old member states than in regions in new member states. Dall'Erba and Le Gallo (2008) include the share of employment in agriculture and long term unemployment as control variables. The share of employment in agriculture is included to control for the industrial sector and is expected to have a negative impact on the regional economic growth. Long term unemployment is assumed to negatively influence productivity and human capital and so negatively affect regional economic growth. In the analysis long term unemployment has the expected effect, but only in the periphery, not in the core. The share of employment in agriculture has a negative, but not significant effect. Cappelen et al. (2003) use the two variables used by Dall'Erba and Le Gallo (2008), as well as physical infrastructure and population density. These two variables are assumed to have a positive effect on regional economic growth. The explanation is that having a dense physical infrastructure and high population density makes it easier for new technology to diffuse. In the analysis by Cappelen et al. (2003) population density has a positive, but not significant effect. Infrastructure has a significant positive effect if time-slope dummies are not included. If time-slope dummies are included the effect changes to significant negative.

3.3. Literature on interaction between regions

Section 2.3. discussed spatial spillover effects. Spatial spillover effects can exist if regions interact. Many variables influence the extent of interaction between regions. Geographical proximity between regions or sharing a border facilitates interaction, for example by low transportation costs. This thesis also uses two other forms of proximity. A first measure used in this thesis is the extent to which regions are equal in institutional quality. The way institutions shape economic behaviour is an economic discipline on its own. Institutional quality is the quality of the legal, political and regulatory framework of a country according to Keefer and Knack (1997). Institutional quality can be measured by various indicators like pervasiveness of corruption, prevalence of rule of law and the extent of trust in an economy (Keefer and Knack 1997; Ederveen et al. 2006). Keefer and Knack (1997), Chong and Calderon (2000) and others conclude that institutional quality influences economic growth. This effect is the

strongest in poorer countries, where a better quality of institutions can help to foster the economy. Coe et al. (2009) find that institutional quality also impact R&D spillovers, one of the most important sectors to which Regional Policy Funds flow. Good institutions thus help regions to properly interact and will therefore increase spatial spillover effects. Improving institutions in poorer regions can help them to catch up with richer regions.

Internet access also facilitates the interaction between regions. Internet access facilitates the development of new products, new processes and new business models. It also makes it easier to share technologies between firms and regions (Czernich et al. 2009). Czernich et al. (2009) for example conclude that a 10 percentage point increase in the percentage of people having broadband internet access increases economic growth per capita by 0.9-1.5 percentage point. Freund and Weinhold (2004) conclude that poorer countries gain more by internet access than richer countries, by having a positive effect on the export of poorer countries. Increasing internet access in poorer regions can therefore have a positive effect on the extent of convergence between countries or regions.

4. Empirical analysis

This chapter starts with describing the origin and characteristics of the used data. A description of the methods used follows, including a description of the production of the spatial weight matrices. The description of the results follows. The discussion of the results ends the chapter.

4.1. Data

The European Commission was contacted to send data about the Regional Policy Funds. September 17, 2015 the European Commission sent in response a dataset that serves as basis for the analysis of this thesis. The dataset contains the allocated Regional Policy Funds payments for 272 NUTS-II regions for the budget period 2007-2013. The payments are the aggregated Funds for the entire period. Of the total 347 million euro of Funds available in this budget period 344.3 million euro can be connected to a specific region. Table 2 gives an overview of the used data and their sources. Appendix A gives the exact data sources. The literature review also discussed the amount of physical infrastructure in a region as control variable. For this variable however no appropriate data are available. Table 3 gives a summary of the most important statistics. For investments only data for the period 2007-2011 were available at the moment. For variables marked with a * in Table 2 not for all stated years data were available for all regions. For these regions the average is taken of the data of the available years. For variables marked with a ® in Table 2 for some countries data were only available on NUTS-I level, the statistical division of the EU regions above NUTS-II. All 272 NUTS-II regions, except Gibraltar, belong to one of the 97 NUTS-I regions. If data are only available on NUTS-I level NUTS-II regions get the value of the variable of the NUTS-I region to which they belong. In the analysis 243 of the 272 NUTS-II regions are used. The excluded regions and the reason of exclusion are given in Appendix B.

A few remarks have to be made about the dataset. The data on the Regional Policy Funds payments concern allocated Funds. It might be the case that the paid out Funds differ from the allocated Funds. Funds can be paid out until two years after the budget, so December 2015. It is thus too early for the European Commission to have a clear overview of the paid out Funds for the budget period 2007-2013. An overview of the Funds paid out until and including 2014 is available, but only on national level, not on NUTS-II level (EU Regional Policy 2015). This overview is shown in Figure 4 in Section 2.2.

4.2. Descriptive analysis

In Figures 5-8 data for all 272 NUTS-II regions (except regions overseas), not only the 243 NUTS-II regions in the dataset, are shown. Figure 5 shows the allocated Regional Policy Funds per NUTS-II region for the complete budget period 2007-2013. An European citizen receives this period on average almost 690 euro of Funds. The median of Funds received by an European citizen is just 222 euro. The average of Funds received by an European citizen is thus more than triple the median amount of Funds

Table 2: Variables and data sources

Variable	*Definition*	*Source*
Variables Solow model		
GDP 2013	Gross Domestic Product in 2013 in PPS per capita	Eurostat
GDP 2007	Gross Domestic Product in 2007 in PPS per capita	Eurostat
Investment*	Average gross fixed capital formation as percentage GDP 2007-2011 (following Mohl and Hagen (2010)	Own calculation based on Eurostat data
Population growth	Average yearly growth of population 2007-2013 in percentage	Own calculation based on Eurostat data
Human capital	Average human resources in science and technology as percentage of active population 2007-2013 (following Olejnik (2008))	Own calculation based on Eurostat data
Main independent variable		
Funds	Allocated Regional Policy Funds per capita 2007-2013	European Commission
Control variables		
Employment agriculture*	Average share of employment in agriculture 2007-2013 (excluding 2009) in percentage	Own calculation based on Eurostat data
Unemployment*	Average long term unemployment (>12 months) 2007-2013 in percentage of active population	Own calculation based on Eurostat data
Population density	Average population density per square kilometre 2007-2013	Own calculation based on Eurostat data
Variables matrix variations		
X coordinate	X coordinate of region	ETIS
Y coordinate	Y coordinate of region	ETIS
Institutional quality®	Institutional quality in 2013	Quality of Government Institute
Internet access®	Percentage households with access to internet at home 2014	Eurostat
Dummy variables		
D_OBJ1	Dummy indicating region is Objective 1 region	Eurostat
D_NEW	Dummy indicating region belongs to member state that entered EU in 2004 and 2007	Eurostat
D_SECOND	Dummy indicating region belongs to second generation EU member state (entrance EU between 1973 and 1995)	Eurostat
D_SOUTH	Dummy indicating region belongs to southern EU member state	Eurostat
D_(country)	26 Dummies indicating region belongs to a certain member state	Eurostat
D_Borders	Dummy indicating region borders a region in another country	Eurostat
D_EU Borders	Dummy indicating region lies at eastern or southern EU border	Own division based on Eurostat data

Source: own work author

received by an European citizen. The division of Funds is thus skewed. A small part of the European citizens receives a big part of the Funds and a large part of the European citizens receive a small part of the Funds. The average amount of Funds a region receives is 1.27 billion euros for the complete period 2007-2013. The region with the highest receipts of Funds is the Spanish region Andalusia with 12.8 billion euros. With 8.2 million citizens this is 1549 euro per capita. The region with the highest allocated amount of Funds per capita is the Portugese region Região Autónoma dos Açores with a little over 5016 euro per capita. Most regions that receive a lot of Funds are found in eastern Europe. Also Portuguese and Spanish regions receive a lot of Funds. It is notable that the regions in Romania and Bulgaria do not belong to the twenty percent highest Funds earning regions. The Finish region Aland is

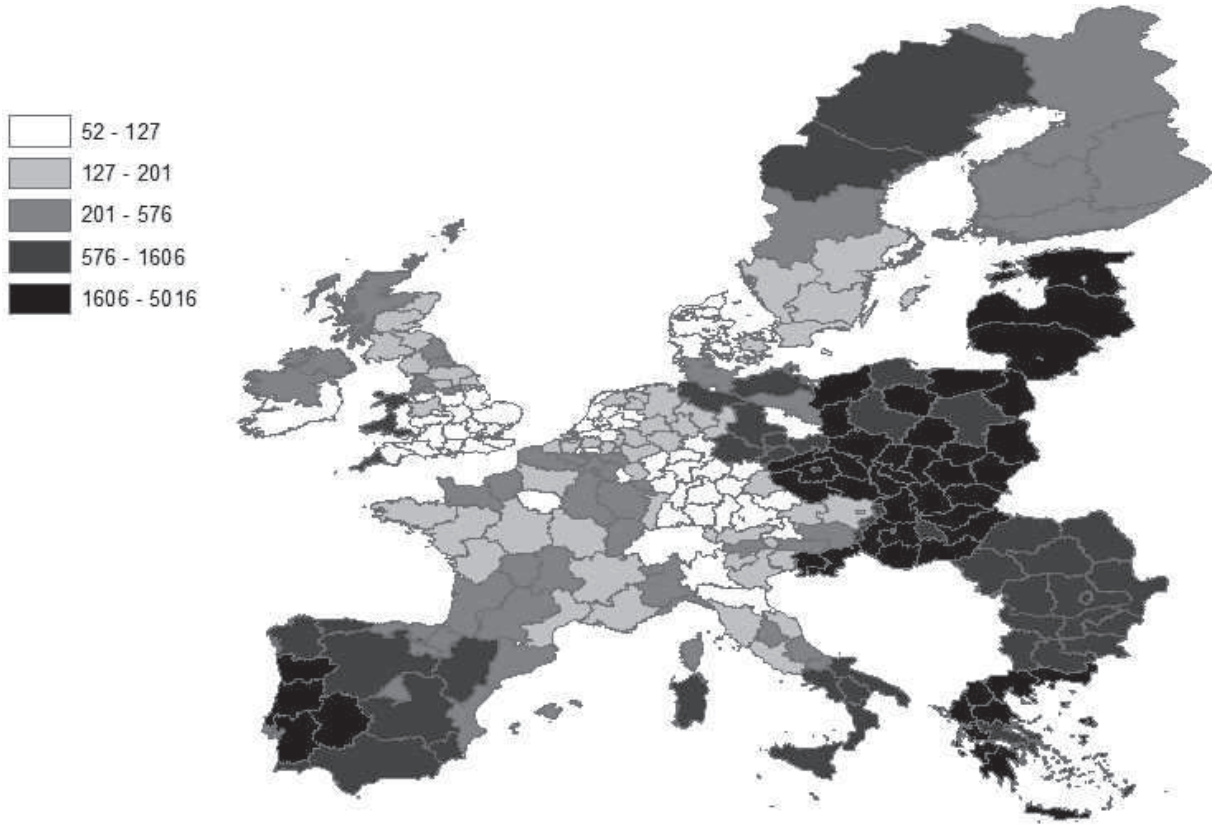
Table 3: Summary statistics (n = 243)

Variable	Unit	Mean	Standard deviation	Minimum	Maximum
GDP 2013 – GDP 2007	PPS per capita	1258.85	2491.63	-5300	11000
GDP 2013	PPS per capita	23618	8364.96	6500	68400
GDP 2007	PPS per capita	24877	8854.38	8000	68500
Investment	% GDP	24.5%	5.0%	11.3%	45.9%
Population growth	% Population	0.2%	0.6%	-2.1%	2.0%
Human capital	% Active population	37.6%	8.5%	16.9%	61.6%
Funds	Euros per capita	787.93	902.70	52.42	3096.99
Employment agriculture	% Employment	5.5%	68%	0.3%	45.1%
Unemployment	% Active population	3.6%	2.3%	0.7%	11.8%
Population density	Population per km²	298.5	555.4	3.1	4087.9

Source: own work author

the lowest earning region with almost 6.7 million euro. This is 242 euro per capita. The lowest earning region per capita is the British region Cheshire. This region receives almost 139 million euros for 2.65 million people, a little over 52 euro per capita. More regions that receive little Funds are found in the United Kingdom, the Netherlands, Denmark and Germany.

Figure 5: Funds per capita per NUTS-II region for complete period 2007-2013 in euros

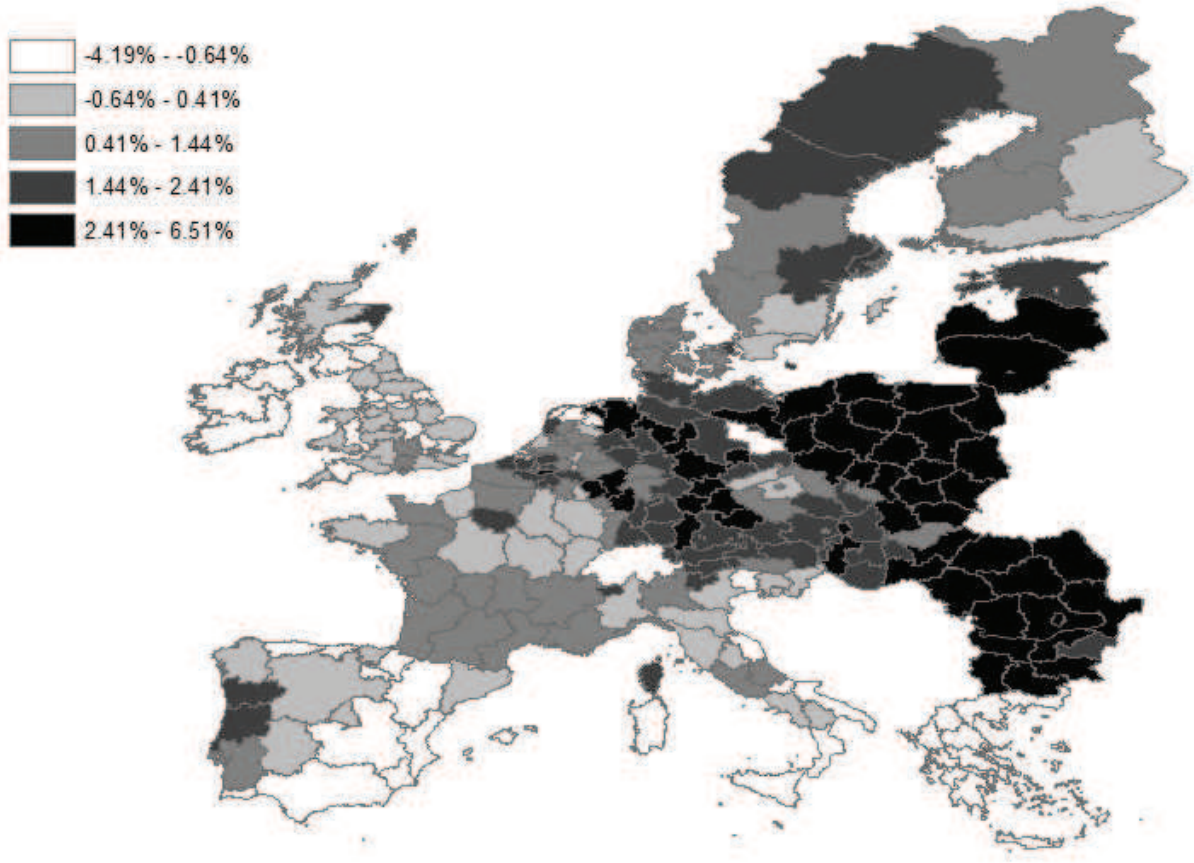


Source: own work author based on data European Commission (2015). Legend shows quintiles, Brandenburg-Südwest not shown as result of reclassification.

Figure 6 shows the average yearly growth in income per capita (PPS) per NUTS-II region between 2007 and 2013. The European regions saw their income per capita on average grow with almost one percent

yearly. Many regions with high growth in income per capita this period are found in eastern Europe. The region with the highest growth in income per capita was the region around the Romanian capital Bucharest Bucureşti – Ilfov with 6.51 percent growth per year. 77 NUTS-II regions saw their income per capita decrease during the period 2007-2013. Greek and Irish regions are among the regions with the highest decrease of income per capita. Also a lot of Italian, Spanish and British regions had difficulties during the economic crisis. The region with the highest loss in income per capita is Ionia Nisia. This Greek region had an average yearly decrease in income per capita of 4.19 percent. This sums to a total loss of almost 23 percent of income between 2007 and 2013.

Figure 6: Average yearly growth in income per capita (PPS) between 2007 and 2013 per NUTS-II region



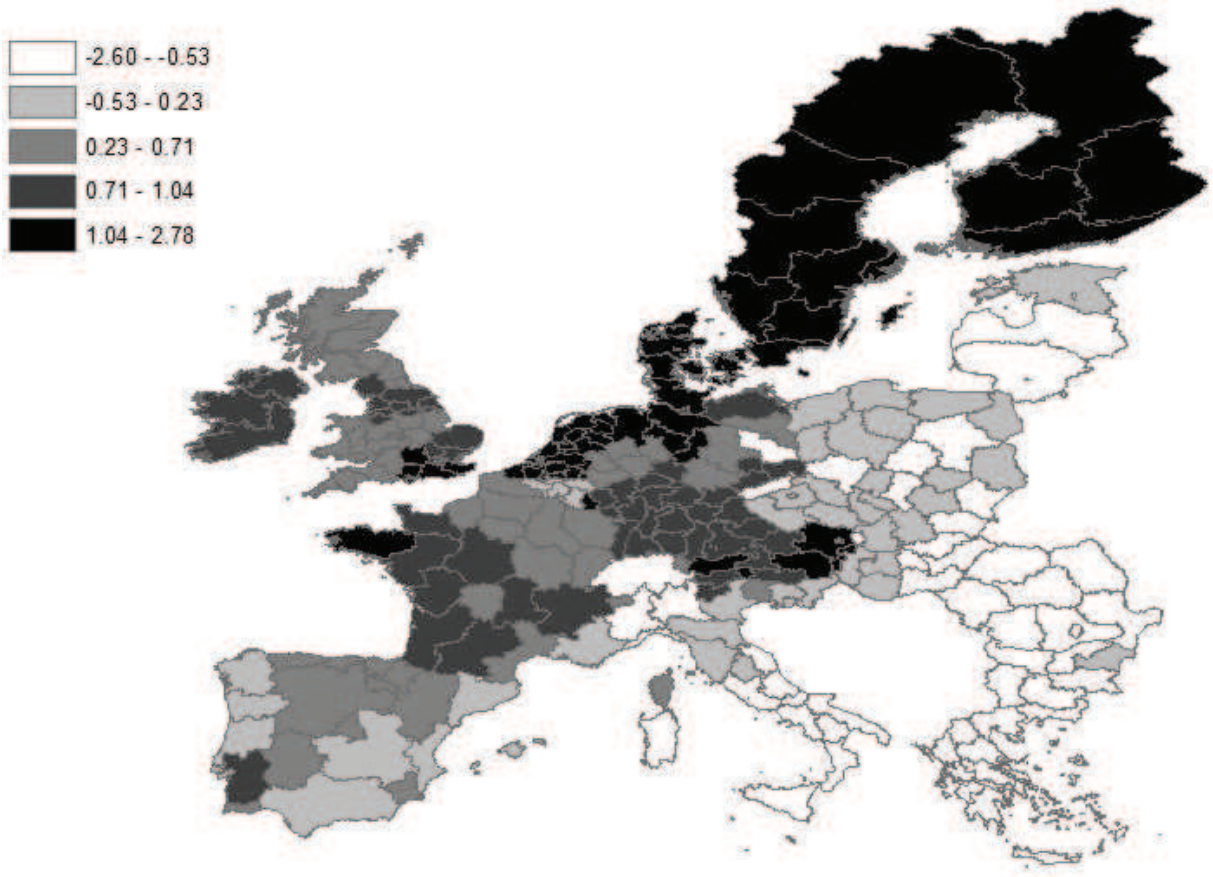
Source: own work author based on data Eurostat (2015). Legend shows quintiles, Brandenburg-Südwest not shown as result of reclassification.

The black indicated regions are often the same in Figure 5 and Figure 6. This means that the regions with the highest growth in income per capita are often the regions with the highest allocated Funds per capita. The white indicated regions are however mostly not the same. The regions with the highest loss in income per capita are thus not the regions with the lowest allocated Funds per capita.

Figures 7 and 8 shows two variables to be used as variation of the spatial weight matrices. Figure 7 shows the institutional quality per region, measured as index number by the Quality of Government

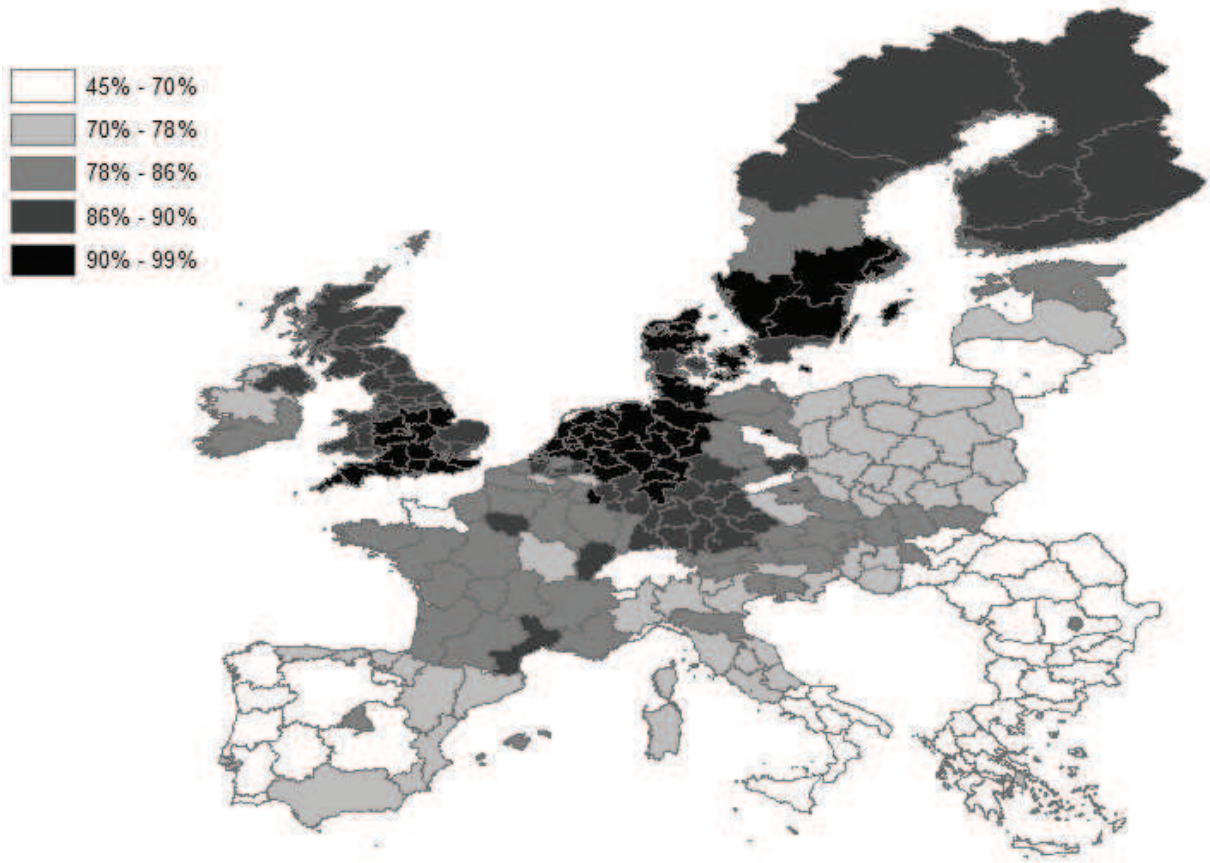
Institute (QGI). The QGI finds that the regions with the highest institutional quality are mostly situated in northern Europe, especially Finland, Sweden, Denmark, the Netherlands and northern Germany. Regions with low institutional quality are mostly found in eastern Europe, especially Romania, Bulgaria, Greece and southern Italy. Figure 8 shows the percentage of households having access to internet per region. In the average region 80 percent of the households has internet access. The extent of internet access is highest in the southern part of Sweden, northern Germany, the Netherlands and the southern part of the United Kingdom. Internet access is lowest in regions in south eastern Europe and on the Iberian peninsula.

Figure 7: Institutional quality per NUTS-I/NUTS-II region as index number



Source: own work author based on data Quality of Governance Institute (2015). Legend shows quintiles, Brandenburg-Südwest not shown as result of reclassification.

Figure 8: Internet access per NUTS-I/NUTS-II region as percentage of households with access to internet



Source: own work author based on data Eurostat (2015). Legend shows quintiles, Brandenburg-Südwest not shown as result of reclassification.

4.3. Methods

The theory part (Section 2.3.) discussed the neoclassical growth model of Solow (1956). The cross-sectional model used in this thesis follows this model and is:

$$\ln(gdp_{i,2013}) - \ln(gdp_{i,2007}) =$$
$$\beta_0 + \beta_1 \ln(gdp_{i,2007}) + \beta_2 \ln(inv_{i,2007-2011}) + \beta_3 (n_{i,2007-2013} + g + \delta) +$$
$$\beta_4 \ln(human_{i,2007-2013}) + \beta_5 \ln(funds_{i,2007-2013}) + \beta_6 \ln(agri_{i,2007-2013}) +$$
$$\beta_7 \ln(unemplo_{i,2007-2013}) + \beta_8 \ln(density_{i,2007-2013}) + u_{i,t} \qquad (7)$$

The meaning of the variables can be found in Table 2. The first four variables (with the coefficients $\beta_1 - \beta_4$) are the variables of the Solow model. g and δ are the rate of technological progress and depreciation rate (fixed at 0.05 by Mankiw et al. (1990)). $funds_{i,2007-2013}$ is the main independent variable of this thesis. The last three variables (with the coefficients $\beta_6 - \beta_8$) are control variables, explained in the literature review (Section 3.2.). $u_{i,t}$ is the error term. β-convergence takes place if β_1 is negative.

The theory part in Section 2.3. discussed spatial spillover effects. To take spatial spillover effects into account a spatial weight matrix W is used. The four spatial weight matrices used in this thesis have 243 rows and 243 columns, corresponding to the 243 regions in the dataset. Each cell W_{ij} in the matrix shows the measured proximity between regions. Often this extent of proximity is the geographical distance between the centroids of region i and region j. This distance is calculated on based on the centroids of the regions and calculated with the following formula:

$$W_{ij} = \sqrt{(\text{latitude}_A - \text{latitude}_B)^2 + (\text{longitude}_A - \text{longitude}_B)^2} \text{ x 111 kilometres} \quad (8)$$

This formula is based on the Pythagorean theorem. 111 kilometres is the distance of one degree of latitude or longitude. A part of the matrix for six Dutch NUTS-II regions below in Table 4 as an example. The diagonal shows only zeros.

Table 4: Example of part of geographical distance spatial weight matrix for six Dutch NUTS-II regions

	Groningen	Friesland	Drenthe	Overijssel	Gelderland	Flevoland
Groningen	0	100.2	28.9	79.9	143.2	145.1
Friesland	100.2	0	92.1	96.7	107.5	66.7
Drenthe	28.9	92.1	0	51.0	115.8	125.1
Overijssel	79.9	96.7	51.0	0	69.4	98.6
Gelderland	143.2	107.5	115.8	69.4	0	62.4
Flevoland	145.1	66.7	125.1	98.6	62.4	0

Source: own work author based on data ETIS (2015)

Each row in the matrix is now standardized, so that all values in a row sum to 1. Standardization is used to prevent the unity of measurement having influence on the regression results. If the six regions in Table 4 would be the only regions in the analysis the standardized matrix would for example be like Table 5. The sum of the values in every row of Table 5 is 1.

Table 5: Example of standardized geographical distance spatial weight matrix for six Dutch NUTS-II regions

	Groningen	Friesland	Drenthe	Overijssel	Gelderland	Flevoland
Groningen	0	0.201	0.058	0.161	0.288	0.292
Friesland	0.216	0	0.199	0.209	0.232	0.144
Drenthe	0.070	0.223	0	0.124	0.280	0.303
Overijssel	0.202	0.244	0.129	0	0.175	0.249
Gelderland	0.287	0.216	0.232	0.139	0	0.125
Flevoland	0.291	0.134	0.251	0.198	0.125	0

Source: own work author based on data ETIS (2015)

The geographical distance spatial weight matrix is the first matrix used in this thesis. The second matrix is the adjacency spatial weight matrix. This matrix is a binary matrix. The matrix shows a 1 if regions share a border and a 0 if not. A part of the matrix with six Dutch NUTS-II regions is shown in Table 6.

The Dutch province of Gelderland for example borders the provinces Flevoland and Overijssel, but does not border the provinces Friesland and Drenthe. Also the adjacency spatial weight matrix is standardized like Table 5 before use in the regression in this thesis.

Table 6: Example of part of adjacency spatial weight matrix for six Dutch NUTS-II regions

	Groningen	Friesland	Drenthe	Overijssel	Gelderland	Flevoland
Groningen	0	1	1	0	0	0
Friesland	1	0	1	1	0	1
Drenthe	1	1	0	1	0	0
Overijssel	0	1	1	0	1	1
Gelderland	0	0	0	1	0	1
Flevoland	0	1	0	1	1	0

Source: own work author

In the literature review (Section 3.3.) also two other variables to use in a spatial weight matrix were discussed: institutional quality and internet access. The matrices with these two variables are the third and fourth spatial weight matrix used in this thesis. To make a matrix of these two variables with STATA a similar formula based on the Pythagorean theorem is used as for the geographical proximity before. For institutional quality the formula is the following one, where IQ is institutional quality:

$$W_{ij} = \sqrt{(\mathrm{IQ}_A - \mathrm{IQ}_B)^2 + (\mathrm{IQ}_A - \mathrm{IQ}_B)^2} \qquad (9)$$

The formula for internet access is similar. STATA needs to have two coefficients to be able to calculate a matrix, so therefore the proximity between two regions (e.g. $\mathrm{IQ}_A - \mathrm{IQ}_B$) is replicated in the formula. As the matrix is standardized, the unit of measurement does not matter.

To integrate the spatial weight matrix in the regression two options are available: the spatial lag model and the spatial error model. The spatial lag model assumes that spatial autocorrelation exists between the values of the dependent variable (Koster and De Graaff 2014). The effect of the Regional Policy Funds in one region is thus influenced by the effect of Regional Policy Funds in the surrounding regions. A new term with a multiplication of the spatial weight matrix and the dependent variable is therefore included in the regression formula:

$$\ln(gdp_{i,2013}) - \ln(gdp_{i,2007}) =$$
$$\beta_0 + \lambda W(\ln(gdp_{i,2013}) - \ln(gdp_{i,2007})) + \beta_1 \ln(gdp_{i,2007}) + \beta_2 \ln(inv_{i,2007-2013}) +$$
$$\beta_3 (n_{i,2007-2013} + g + \delta) + \beta_4 \ln(human_{i,2007-2013}) + \beta_5 \ln(funds_{i,2007-2013}) +$$
$$\beta_6 \ln(agri_{i,2007-2013}) + \beta_7 \ln(unemplo_{i,2007-2013}) + \beta_8 \ln(density_{i,2007-2013}) + u_{i,t} \qquad (10)$$

In this spatial lag model W is the spatial weight matrix and λ the coefficient of the multiplication of W and the dependent variable. The spatial error model assumes that the residuals of the analysis are

spatially autocorrelated instead of the values of the dependent variable. The formula of the spatial error model is therefore as follows:

$$\ln(gdp_{i,2013}) - \ln(gdp_{i,2007}) =$$
$$\beta_0 + \beta_1 \ln(gdp_{i,2007}) + \beta_2 \ln(inv_{i,2007-2013}) + \beta_3 (n_{i,2007-2013} + g + \delta) +$$
$$\beta_4 \ln(human_{i,2007-2013}) + \beta_5 \ln(funds_{i,2007-2013}) + \beta_6 \ln(agri_{i,2007-2013}) +$$
$$\beta_7 \ln(unemplo_{i,2007-2013}) + \beta_8 \ln(density_{i,2007-2013}) + (I - \lambda W)^{-1}\mu \qquad (11)$$

The term $(I - \lambda W)^{-1}\mu$ is the spatial autocorrelated error term. λ and W have the same meaning as in the spatial lag model. I is an identity matrix and μ a random effect.

With a test statistic called Moran's I one can test whether spatial autocorrelation exists in a regression. If this is the case, a Lagrange Multiplier test can show whether the spatial lag model or the spatial error model should be used to take account of the spatial autocorrelation in the analysis (Koster and De Graaf 2014).

In every results table below eight regressions are shown. Table 7 gives an overview of the regressions. Figure A2 in Appendix C shows three maps with divisions of regions. The upper map shows the division for the regressions in Columns 2 and 3. The middle map shows the division for the regression in Column 4. The division for the regressions in Columns 6 and 7 is shown in the lower map of Figure A2.

Table 7: Overview of regressions in results tables

Column 1	Division between Objective 1 regions and Objective 2 regions
Column 2	Division between regions in old member states and regions in new member states
Column 3	Division between regions in founding EU member states, second generation member states and new member states
Column 4	Division between regions in northern Europe and southern Europe
Column 5	Division between the 27 EU member states
Column 6	Division between regions that border another country and regions that do not
Column 7	Division between regions that border southern and eastern EU border and regions that do not
Column 8	Amalgamation variables first seven columns (except country dummies column 5)

4.4. Results

The method section explained the four spatial weight matrices used in the analyses. This section gives the results of these analyses. In the main part only four tables (Tables 8-11) are included. More tables are included in Appendix C. Table A2 shows a classic analysis with interaction variables. The coefficients of the country dummies of Table A2 are given in Table A1. Tables A3-A14 give more information about the analyses with the four spatial weight matrices. Moran's I indicates the existence of spatial autocorrelation in all four regressions. The result of the Lagrange Multiplier tests indicates a preference of the spatial lag model over the spatial error model, expect for the regression with the institutional quality spatial weight matrix. For the latter the spatial error model is used.

Table 8: Spatial analysis with geographical distance spatial weight matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.107***	-0.105***	-0.102***	-0.047*	-0.022	-0.130***	-0.133***	-0.057**
Investment	0.007	0.023	0.019	0.025	-0.031	0.017	0.024	0.005
Popul. Growth	-0.185***	-0.209***	-0.222***	-0.237***	-0.038	-0.201***	-0.217***	-0.189***
Human capital	0.142***	0.138***	0.135***	0.110***	0.124***	0.142***	0.145***	0.085***
Funds (F)	-0.010	-0.016**	-0.007	0.017***	0.015	-0.012*	-0.007	-0.019
D_OBJ1	0.451***							0.778***
D_OBJ1 x F	-0.056***							-0.099***
D_NEW		0.268**	0.271**					0.142
D_NEW x F		-0.030*	-0.034					-0.012
D_SECOND			-0.029					-0.108*
D_SECOND x F			-0.002					0.013
D_SOUTH (D_S)				0.247***				0.093
D_SOUTH x F				-0.050***				-0.020
D_SxD_NEW				0.769*				-0.128
D_SxD_NEW x F				-0.092				0.014
D_Belgium x F					0.022			
D_Bulgaria x F					0.232			
D_Czech Rep. x F					0.080			
D_Germany x F					-0.239			
D_Denmark x F					0.002			
D_Ireland x F					-0.049			
D_Greece x F					0.015			
D_Spain x F					-0.005			
D_France x F					-0.049			
D_Italy x F					-0.0275			
D_Hungary x F					0.048			
D_Netherlands x F					-0.058			
D_Austria x F					-0.017			
D_Poland x F					-0.014			
D_Portugal x F					0.032			
D_Romania x F					-0.167			
D_Slovenia x F					1.494			
D_Slovakia x F					0.091			
D_UK x F					-0.008			
D_Borders						-0.021		-0.053
D_Borders x F						0.0066		0.012
D_EU Borders							0.004	-0.006
D_EU Borders x F							0.001	0.001
Agri-employment	0.002	0.003	0.001	0.024***	0.003	0.007	0.003	0.009
Unemployment	-0.043***	-0.034***	-0.046***	-0.032***	-0.026**	-0.044***	-0.0476***	-0.037***
Density	0.013**	0.012**	0.009	0.023***	-0.003	0.019***	0.017***	0.013**
Constant	0.651**	0.610*	0.578*	-0.274	0.201	0.824***	0.818***	0.174
Lambda	1.862***	1.768***	0.930***	0.950***	-0.398	1.835***	1.861***	0.902***
Sigma2	0.004***	0.004***	0.001***	0.004***	0.001***	0.004***	0.004***	0.004***
AIC	-626.06	-627.21	-616.99	-603.86	-797.94	-617.93	-613.50	-624.93
Observations	243	243	243	243	243	243	243	243
Standard errors in parentheses		*** p<0.01, ** p<0.05, * p<0.1			Coefficients country dummies in Appendix C (Table A5)			

Table 8 shows the results of the spatial cross-sectional analysis with a geographical distance spatial weight matrix. To secure readability of the table the standard errors and the coefficients of the country dummies are omitted. The same table with standard errors is included as Table A3 in Appendix C. The coefficients of the country dummies are shown in Table A5. The same analysis without interaction variables is shown in Table A4.

In Table 8 the logarithm of the economic growth between 2007 and 2013 is the dependent variable (GDPDIF). The coefficients of the variables of the Solow model are consistent with the theory. The GDP in 2007 is negative and strongly significant correlated with the economic growth over the period 2007-2013. The coefficient of the investment variable is positive, but not significant. Population growth is

negative and strong significantly correlated with economic growth. The coefficient of the human capital variable is positive and strongly significant. The findings for the most important variable, the Regional Policy Funds variable, are mainly negative, but mostly not significant. The control variables show various results. The employment share of agriculture has almost no correlation with economic growth. The coefficient of the long term unemployment variable is strongly significant negative. Density is positively and significantly correlated with economic growth.

Table 8 also shows the regressions explained in Table 7. The economic growth shows a different pattern over the European regions. Objective 1 regions (D_OBJ1) had a significant higher economic growth in the period 2007-2013 than Objective 2 regions (Column 1). Poorer regions in Europe were thus able to catch up somewhat with the richer European regions. The interaction effect between the Objective 1 dummy (D_OBJ1) and the Funds variable is negative and significant. The higher economic growth for Objective 1 regions is thus not the result of the Funds. The results even indicate that the Objective 1 regions would have grown more without the Funds. As most regions in the new EU countries are Objective 1 regions, it does not surprise that regions in new EU countries (D_NEW) had a strongly significant higher economic growth than regions in old EU countries (Column 2). Also this growth is not caused by the Regional Policy Funds. Regions in the new EU countries had a significant higher economic growth than regions in the six founding nations. Regions in the second generation member states (D_SECOND) had a lower, but not significant economic growth than the regions in the six founding nations. The interaction variables show no significant effect. Column 4 shows that regions in southern Europe had a significant higher economic growth than regions in northern Europe. This difference is however not caused by the Regional Policy Funds, as the interaction variable between the region in southern Europe (D_SOUTH) and the Funds variable is significantly negative. The interaction variable between the region in southern Europe (D_SOUTH) and regions in new EU nations (D_NEW) is significantly positive. This indicates a relatively high economic growth for Romania and Bulgaria, the two southern European countries that are new EU member states.

Column 5 shows that the economic growth of none of the EU countries can be significantly connected to the Funds. Interaction variables are only used for countries with more than one region in the dataset to prevent issues of multicollinearity. As the Swedish regions have an average economic growth most close to the EU regions average, Sweden is the reference country. Columns 6 and 7 differentiate between border regions and non-border regions. Regions that share a border with another country (D_Borders) had no significant different economic growth than regions that do not (Column 6). The regions at the EU southern and eastern border (D_EU Borders) had no significant different economic growth than other EU-regions (Column 7).

Table 9: Spatial analysis with adjacency spatial weight matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.111***	-0.066**	-0.086***	-0.015	-0.025	-0.142***	-0.137***	-0.030
Investment	0.029	0.040	0.019	0.035	-0.033	0.023	0.039	0.007
Popul. growth	-0.346***	-0.362***	-0.270***	-0.301***	-0.044	-0.334***	-0.371***	-0.230***
Human capital	0.197***	0.167***	0.141***	0.103***	0.130***	0.193***	0.194***	0.079**
Funds (F)	0.004	-0.018**	-0.001	0.034***	0.016	0.001	0.016**	-0.013
D_OBJ1	0.354*							0.821***
D_OBJ1 x F	-0.039							-0.104***
D_NEW		0.160	0.240*					0.108
D_NEW x F		-0.003	-0.022					-0.004
D_SECOND			-0.043					-0.116*
D_SECOND x F			-0.005					0.011
D_SOUTH (D_S)				0.345***				0.106
D_SOUTH x F				-0.071***				-0.024
D_SxD_NEW				0.926**				0.091
D_SxD_NEW x F				-0.110*				-0.018
D_Belgium x F					0.020			
D_Bulgaria x F					0.196			
D_Czech Rep. x F					0.071			
D_Germany x F					-0.295			
D_Denmark x F					-0.002			
D_Ireland x F					-0.050			
D_Greece x F					0.008			
D_Spain x F					-0.009			
D_France x F					-0.053			
D_Italy x F					-0.027			
D_Hungary x F					0.048			
D_Netherlands x F					-0.064			
D_Austria x F					-0.019			
D_Poland x F					-0.019			
D_Portugal x F					0.033			
D_Romania x F					-0.148			
D_Slovenia x F					1.282			
D_Slovakia x F					0.079			
D_UK x F					-0.010			
D_Borders						0.014		-0.030
D_Borders x F						0.005		0.009
D_EU Borders							0.011	-0.007
D_EU Borders x F							0.004	0.002
Agri-employment	0.006	0.011	0.002	0.033***	0.004	0.013	0.007	0.011
Unemployment	-0.074***	-0.042***	-0.054***	-0.037***	-0.026**	-0.073***	-0.080***	-0.042***
Density	0.018***	0.013*	0.007	0.028***	-0.003	0.028***	0.024***	0.012*
Constant	0.317	-0.088	0.315	-0.845**	0.175	0.566	0.425	-0.198
Lambda	0.048***	0.024*	0.019	0.030**	-0.010	0.043***	0.049***	0.017
Sigma2	0.006***	0.005***	0.007***	0.005***	0.001***	0.006***	0.006***	0.004***
AIC	-520.35	-552.05	-583.50	-560.32	-797.47	-524.61	-512.16	-598.67
Observations	243	243	243	243	243	243	243	243
Standard errors in parentheses		*** p<0.01, ** p<0.05, * p<0.1			Coefficients country dummies in Appendix C (Table A6)			

Table 9 shows the results of the regression with the adjacency spatial weight matrix. The full analysis is included as Table A7. The same analysis without interaction variables is included as Table A8. The coefficients of the variables of the Solow model are again consistent with theory. The effect of the Funds variable is more positive in this analysis than in Table 8. The results for the effects are now mixed with different degrees of significance. Objective 1 regions have significant higher economic growth, but this higher growth cannot be attributed to the Regional Policy Funds. New regions show significant higher growth than regions in the founding old member states, but also this higher growth cannot be seen as a result of the Funds. Regions in southern Europe had strongly significant higher economic growth, but the Regional Policy Funds had a strongly significant negative impact on this growth

Table 10: Spatial analysis with institutional quality spatial weight matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.116***	-0.078***	-0.081***	-0.036	-0.022	-0.153***	-0.149***	-0.025
Investment	-0.023	0.002	0.004	-0.009	-0.033	-0.005	-0.002	-0.004
Popul. growth	-0.229***	-0.269***	-0.250***	-0.201***	-0.046	-0.253***	-0.272***	-0.216***
Human capital	0.155***	0.140***	0.132***	0.103***	0.127***	0.170***	0.163***	0.085***
Funds (F)	0.007	-0.006	-0.001	0.033***	0.017	0.008	0.015**	-0.015
D_OBJ1	0.667***							0.755***
D_OBJ1 x F	-0.082***							-0.094***
D_NEW		0.270**	0.308**					0.133
D_NEW x F		-0.020	-0.028					-0.005
D_SECOND			-0.039					-0.117*
D_SECOND x F			-0.001					0.016
D_SOUTH (D_S)				0.260***				0.117
D_SOUTH x F				-0.056***				-0.026*
D_SxD_NEW				0.905*				-0.158
D_SxD_NEW x F				-0.105				0.023
D_Belgium x F					0.018			
D_Bulgaria x F					0.153			
D_Czech Rep. x F					0.074			
D_Germany x F					-0.268			
D_Denmark x F					-0.001			
D_Ireland x F					-0.051			
D_Greece x F					0.012			
D_Spain x F					-0.008			
D_France x F					-0.052			
D_Italy x F					-0.027			
D_Hungary x F					0.045			
D_Netherlands x F					-0.067			
D_Austria x F					-0.007			
D_Poland x F					-0.022			
D_Portugal x F					0.030			
D_Romania x F					-0.127			
D_Slovenia x F					1.411			
D_Slovakia x F					0.071			
D_UK x F					-0.008			
D_Borders						-0.0343		-0.052
D_Borders x F						0.00941		0.011
D_EU Borders							0.011	0.004
D_EU Borders x F							0.004	0.002
Agri-employment	0.022**	0.028***	0.024**	0.044***	0.004	0.027***	0.023**	0.029***
Unemployment	-0.078***	-0.045***	-0.049***	-0.034***	-0.026**	-0.079***	-0.081***	-0.038***
Density	0.023***	0.023***	0.021***	0.032***	-0.002	0.032***	0.030***	0.022***
Constant	0.558	0.103	0.186	-0.430	0.127	0.847**	0.729*	-0.284
Rho	0.590***	0.563***	0.513***	0.546***	0.054	0.538***	0.559***	0.501***
Sigma2	0.004***	0.0046***	0.004***	0.004***	0.001***	0.005***	0.005***	0.003***
AIC	-580.16	-605.22	-612.74	-607.07	-796.36	-564.96	-562.43	-623.76
Observations	243	243	243	243	243	243	243	243
Standard errors in parentheses		*** p<0.01, ** p<0.05, * p<0.1			Coefficients country dummies in Appendix C (Table A11)			

The interaction variables for countries show mixed signs, but no significance. No significant differences are seen between the economic growth of border regions and non-border regions.

Table 10 shows the results of the regression with the institutional quality spatial weight matrix. The full analysis is included as Table A9. The same analysis without interaction variables is included as Table A10. The variables of the Solow model do not show different results than before. The employment in agriculture variable shows a remarkable result. In this analysis the share of employment in agriculture has a positive effect on economic growth. This result can be connected to the higher economic growth of poorer regions, as the GDP 2007 variable shows. The findings for the effect of the Regional Policy Funds are somewhat positive in this analysis. Two regressions show significantly higher economic

Table 11: Spatial analysis with internet access spatial weight matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.084***	-0.043*	-0.067***	0.005	-0.020	-0.110***	-0.105***	-0.016
Investment	0.028	0.035	0.016	0.031	-0.031	0.023	0.037	0.007
Popul. growth	-0.342***	-0.347***	-0.269***	-0.287***	-0.047	-0.329***	-0.361***	-0.229***
Human capital	0.180***	0.154***	0.137***	0.101***	0.127***	0.176***	0.178***	0.083**
Funds (F)	0.009	-0.009	0.001	0.035***	0.017	0.013	0.019***	-0.009
D_OBJ1	0.298*							0.653***
D_OBJ1 x F	-0.033							-0.082**
D_NEW		0.207	0.249*					0.110
D_NEW x F		-0.012	-0.023					-0.004
D_SECOND			-0.069					-0.116*
D_SECOND x F			0.002					0.013
D_SOUTH (D_S)				0.259***				0.066
D_SOUTH x F				-0.056***				-0.017
D_SxD_NEW				1.152***				0.387
D_SxD_NEW x F				-0.143**				-0.059
D_Belgium x F					0.020			
D_Bulgaria x F					0.134			
D_Czech Rep. x F					0.079			
D_Germany x F					-0.242			
D_Denmark x F					0.001			
D_Ireland x F					-0.050			
D_Greece x F					0.014			
D_Spain x F					-0.006			
D_France x F					-0.049			
D_Italy x F					-0.025			
D_Hungary x F					0.048			
D_Netherlands x F					-0.063			
D_Austria x F					-0.004			
D_Poland x F					-0.025			
D_Portugal x F					0.031			
D_Romania x F					-0.136			
D_Slovenia x F					1.393			
D_Slovakia x F					0.089			
D_UK x F					-0.009			
D_Borders						0.016		-0.020
D_Borders x F						0.004		0.007
D_EU Borders							0.006	-0.006
D_EU Borders x F							0.003	0.002
Agri-employment	0.007	0.011	0.003	0.031***	0.003	0.013	0.008	0.011
Unemployment	-0.069***	-0.041***	-0.051***	-0.036***	-0.027**	-0.068***	-0.073***	-0.039***
Density	0.017***	0.012**	0.007	0.025***	-0.003	0.025***	0.022***	0.011*
Constant	-0.005	-0.355	0.095	-1.020***	0.114	0.206	0.091	-0.363
Lambda	0.387***	0.339***	0.284***	0.322***	0.0284	0.377***	0.398***	0.240***
Sigma2	0.005***	0.005***	0.004***	0.005***	0.001***	0.005***	0.005***	0.0045***
AIC	-550.18	-581.41	-604.78	-583.96	-796.50	-554.70	-543.11	-613.88
Observations	243	243	243	243	243	243	243	243
Standard errors in parentheses		*** p<0.01, ** p<0.05, * p<0.1			Coefficients country dummies in Appendix C (Table A12)			

growth as a result of the Funds. The analysis in Table 9 shows significant higher economic growth for Objective 1 regions, regions in new EU countries and regions in southern Europe. The Regional Policy Funds do however negatively impact this growth, significantly in case of the Objective 1 regions and regions in southern Europe. The interaction variables for countries show mixed signs, but no significance. The border regions do not achieve different results than non-border regions in this regression.

Table 11 shows the results of the spatial analysis with the internet access spatial weight matrix. The full analysis is included in Appendix C as Table A13. Table A14 shows the same analysis without

interaction variables. The variables of the Solow model show the same results as before, although Column 4 shows an insignificant positive result for the GDP 2007 variable. Table 11 shows the most positive results for the effect of the Regional Policy Funds. The Regional Policy Funds mostly have a positive effect with different rates of significance. Objective 1 regions and regions in new EU member states have a significant higher economic growth than other regions. The Regional Policy Funds did not influence this result. Southern regions have a higher economic growth than northern regions, but the Regional Policy Funds did negatively affect this growth. The country effects do not show significant effects. Border regions do not show different effects than non-border regions.

All four tables show the existence of β-convergence, as the coefficient of the GDP 2007 variable is almost always negative. The standard deviation of the log GDP per capita of the regions decreases from 0.17 in 2007 to 0.16 in 2013. Next to β-convergence also s-convergence is thus taking place. Comparing the tables on basis of the Akeike information criterion (AIC) Table 8 has the lowest average AIC, averaged over the eight columns of the table. The regression with the geographical distance spatial weight matrix is therefore the best fitting model. Second best is the regression with the institutional quality spatial weight matrix, followed by the regression with the internet access spatial weight matrix. The regression with the adjacency spatial weight matrix is the worst fitting model.

4.5. Discussion

Reflection on results

When comparing the four results tables three points are outstanding. The first point is that poor regions have on average higher economic growth than rich regions in the budget period 2007-2013, thus convergence is taking place. The second point is that the Regional Policy Funds do not have a significant effect on economic growth. The convergence of the regions can thus not be attributed to the Regional Policy Funds. The third point is that the Regional Policy Funds sometimes negatively affect the growth of the highest earners of the Funds. The goal of the Regional Policy Funds, convergence, is thus reached, but this is not due to the Regional Policy Funds. This lack of efficiency of the Regional Policy Funds can also be seen in a comparison between Figures 9 and 10. Both figures show the average yearly economic growth over the period 2007-2013 on the horizontal axes and the Funds per capita for the complete period 2007-2013 in euros on the vertical axes. The dots in the graphs are the regions. Figure 9 shows all regions in the dataset. In this figure Funds per capita are significantly and positively correlated with the average yearly economic growth ($p = 0.067$). Figure 9 thus gives a positive view on the effect of the Regional Policy Funds. Figure 10 does give a different picture. Figure 10 only shows the Objective 1 regions. In this figure the Funds per capita are strongly negatively correlated with the average yearly economic growth ($p = 0.000$). The Objective 1 regions with the highest economic growth were thus on average the Objective 1 regions with the least Funds per capita received.

Figure 9: Correlation economic growth and Funds per capita all regions (n = 243)

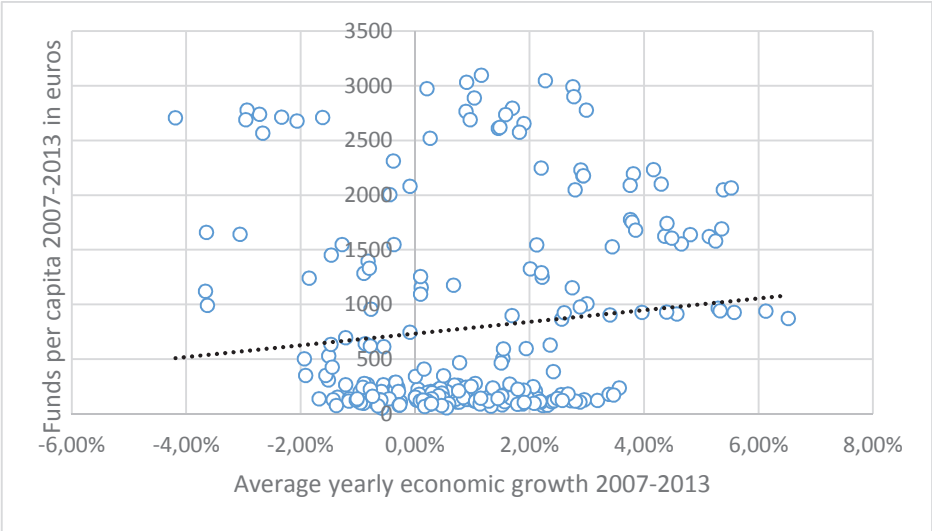


Figure 10: Correlation economic growth and Funds per capita Objective 1 regions (n = 77)

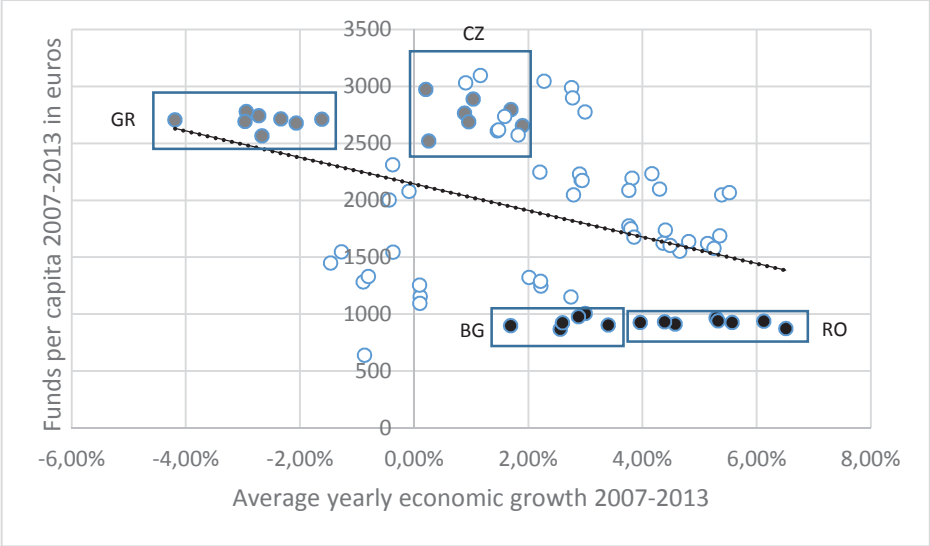
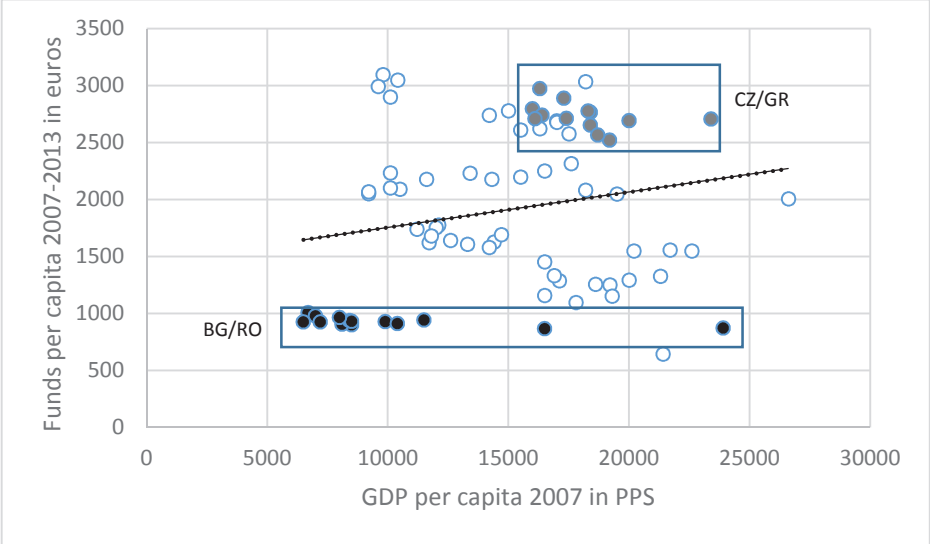


Figure 11: Correlation GDP per capita 2007 (PPS) and Funds per capita Objective 1 regions (n = 77)



Source Figures 9-11: own work author based on data Eurostat (2015) / European Commission (2015)

Figure 11 shows the correlation between the GDP per capita in 2007 (PPS) and the Funds per capita for the complete period 2007-2013 for all 77 Objective 1 regions. In this figure the GDP per capita in 2007 is significantly and negatively correlated with the Funds per capita ($p = 0.085$). The higher the GDP per capita in 2007, the higher the amount of Funds the region thus receives. It thus seems to be the case that the Regional Policy Funds are not primarily allocated on basis of the income of the region. As a robustness check the same graph is included as Figure A3 in Appendix C, but then with normal GDP per capita instead of GDP per capita in PPS. In this figure the GDP per capita in 2007 is significantly negatively correlated with the Funds per capita ($p = 0.091$). The shown results in Figure A3 do thus not significantly differ from the results in Figure 11.

In Figures 10 and 11 the Objective 1 regions of four countries are highlighted. The seven Czech (CZ) and eight Greek (GR) regions are grey colored. The six Bulgarian (BG) and eight Romanian (RO) regions are black colored. Despite their high receipts of Regional Policy Funds the Czech and Greek regions did not perform well during the period 2007-2013. Especially the Greek regions performed negatively with yearly economic losses between 1.5 and 4.5 percent per region. Bulgarian and especially Romanian regions are among the best performing regions in the period 2007-2013. These regions are however also among the Objective 1 regions with the least receipts of Funds per capita. Figure 11 shows that the Czech and Greek regions received a lot of Funds while being relatively rich already. Bulgarian and Romanian regions were among the poorest Objective 1 regions, but received relatively little Funds per capita. The stories of Figures 10 and 11 combined explain the finding that Regional Policy Funds negatively affected the economic growth of Objective 1 regions.

The results of this thesis are more negative than the results of earlier research on the effect of the Regional Policy Funds, discussed in Chapter 3. Dall'erba and Le Gallo (2008) is an example of an article that shows similar results as this thesis, namely that the Structural Funds do not significantly impact convergence of the EU regions. As possible explanation for this finding Dall'erba and Le Gallo find that the rich core regions are more connected with each other than the poor regions in the periphery. Investments in the core regions create thus more spatial spillover effects than investments in the peripheral regions. This may also explain the lack of the effect of the Regional Policy Funds in this thesis, but this would require additional research.

An example of a research with results contradicting the results of this thesis is Becker et al. (2012). Becker et al. find a positive effect of the Regional Policy Funds on EU regions in the budget periods 1994-1999 and 2000-2006. An interesting feature of their research is the search for a more efficient allocation of the Funds. Becker et al. show that receipts of Funds above the size of 1.3 percent of regional GDP, measured at the start of the budget period, do not impact regional growth. In this thesis 61 out of 272 NUTS-II regions yearly receive more Funds than the size of 1.3 percent of their regional

GDP. Additional research could explore what impact reallocation of the Regional Policy Funds would have in the EU with the new eastern European member states.

Reflection on models and method

Section 2.3. discussed two models that can provide insights in the working of funds like the Regional Policy Funds. One of the models, the Solow model, was used as basis for the regression analysis in this thesis. The coefficients of the variables of the Solow model (GDP2007, investment, population growth, human capital) are consistent with the theory. Also the coefficients of the three control variables (employment agriculture, long term unemployment, population density) are consistent with theory. The Funds variable is the only variable that shows a counterintuitive result. The Regional Policy Funds do not have a permanent effect on production and income in this thesis. In the Solow model the relative high growth of income of poor EU regions in the budget period 2007-2013 can therefore only be explained by other investments than those financed by the Regional Policy Funds. Apparently investors do not need the Regional Policy Funds to be stimulated to investment in the poor EU regions. In economic theory this makes sense, as the marginal rate of capital decreases. The return on capital is in economic theory thus expected to be higher in the poor EU regions with a low capital level than in the rich EU regions with a high capital level. Investors behave according to this insight. Also the new EU membership of the twelve eastern European countries might have given investors so many incentives to invest in these countries that the Regional Policy Funds were not needed anymore to motivate investors.

The core-periphery model was the other model discussed in theory. The Regional Policy Funds are meant as a dispersion force to move economic activity from the core of the EU to the periphery. The regression results show that the periphery of the EU has indeed grown in economic importance compared with the core. The growth of economic activity is however the biggest in that part of the periphery that received relatively little Funds. This growth in economic activity can therefore not be attributed to the Regional Policy Funds. The Regional Policy Funds did thus not function as a dispersion force as meant by the EU. Other dispersion forces, not discussed in this thesis, however seem to attract investors to the poor EU regions.

To take spatial spillover effects into account spatial econometric techniques were used in the regression analysis. Four different spatial weight matrices were used. In Appendix C (Table A2) the class cross-sectional analysis is shown as a fifth model. The regression results of the four models without interaction variables are also included in Appendix C. The variables of the Solow model and the control variables show similar results in the different regressions. The effect of the Funds variable is a little more positive in the regressions with the institutional quality and especially the internet access spatial weight matrix. The strongest effects of the dummy variables are found in the regression

with the geographical distance spatial weight matrix. This is not surprising, as this regression analysis has the lowest AIC averaged over the eight regressions in the table and is thus the best fitting regression in this thesis. The regressions in Appendix C without interaction variables do show stronger effects for the dummy variables than the four regressions with interaction variables. Interacting the dummy variables with the Funds variable thus leads to less strong effects. Including spatial econometric techniques turns out to be useful, as three spatial regressions score a lower average AIC than the classic regression in Table A2. Only the regression with the adjacency spatial weight matrix scores a higher average AIC than the classic regression.

Limitations and suggestions for further research

In this thesis the Solow model is used as theoretical basis. The Solow model does however have some limitations. First, the labour force is fixed in the Solow model. The model thus cannot correct for labour movements. The EU enlargement in 2004 and 2007 did however create some labour movements from eastern European countries, especially Poland, to western Europe. Besides it would be interesting to see if the investments of the Regional Policy Funds lead to labour movements. The Solow model however cannot take this into account. A second point is about the role of technology. Technological progress is the driver of economic progress in the Solow model. The Solow model however does not explain the forces behind technological progress. In this thesis the Regional Policy Funds are assumed to lead to more investments. The Regional Policy Funds are however also assumed to lead to technological progress, for example by financing research and development. The Solow model can however not deal with factors influencing technological progress. Endogenous growth models are capable of factors influencing technological progress (Romer 1986).

In this thesis the best model to use for a regression analysis about the Regional Policy Funds is a spatial analysis with a geographical distance spatial weight matrix. The variations with the institutional quality and internet access spatial weight matrix however do score well with a lower average AIC than the regression with the adjacency spatial weight matrix. Ideas for other variations of spatial weight matrices are political preferences, demography, degree of openness and degree of urbanization. Political preferences can for example be measured by the percentage of people that voted for a left-wing political party in the European elections of 2009 in a region. The percentage of people under thirty in a region can be indicator for the demography of a region. The openness of a region can for example be measured by the net immigration ratio of a region. The percentage of people living in a city can be an indicator of the degree of urbanization of a region. The thought behind all four ideas is that similar regions interact more and will therefore converge more to each other.

Section 4.1. already described the biggest challenge of this thesis: dealing with non-available data. Some improvements are possible regarding the data used in this analysis. Availability of data for all

regions and years will be a first improvement. 12 regions were excluded of the dataset for a lack of data on some important variables. For some variables not for all years between 2007 and 2013 data were available. Especially the years 2012 and 2013 did sometimes lack data. More data are expected to become available in the coming years about this period, so this leaves room for further research.

A second improvement is associated with the dataset sent by the European Commission on the allocated Regional Policy Funds. As the Funds can be paid out until the end of 2015, the European Commission does not have a clear overview of the paid out Funds at moment of writing. This overview will become available in the future. This has two advantages for further research. First, the paid out Funds can be used instead of the allocated Funds. Second, year data will be available instead of only data for the complete period 2007-2013. With year data the analysis would become a panel data analysis instead of a cross-sectional analysis. A panel data analysis can deal with entity and time fixed effects. This leads to a more precise estimation of the effect of the Regional Policy Funds.

Including lags would be a third possible improvement. The effect of some investments may only be seen after a couple of years. The effect of Regional Policy Funds will not have been fully developed at the end of the period 2007-2013. The effect measured in this research will thus not be the full effect of the Funds. In this research only GDP data were available until and including 2013. When GDP data from 2014 onwards become available, including lags will be become possible.

5. Conclusion

The Regional Policy Funds of the EU have the purpose of convergence, thus decreasing the disparities between the European regions. In 2004 ten eastern European countries entered the EU. In 2007 Romania and Bulgaria entered. The budget period 2007-2013 was thus the first period with 27 member states to profit from the Regional Policy Funds. This thesis is the first research to determine whether the Regional Policy Funds in the budget period 2007-2013 have led to more convergence of the EU regions. A poor region converges if its GDP per capita increases more than the average GDP per capita of the EU regions. The regions in this thesis are the 272 NUTS-II regions of the EU. The societal relevance of this thesis is to check whether the EU succeeds in increasing economic cohesion with the Regional Policy Funds. This helps policymakers to improve the policy. Better policy helps poorer regions to develop quicker and better, of which their citizens profit.

The first sub-research question was: 'What are the Regional Policy Funds and what is the economic reasoning behind them?'. Since 1973 the three funds of the Regional Policy Funds try to help EU regions with a GDP below 75 percent of the EU average. In het budget period 2007-2013 the EU yearly spends 50 billion euros through the Regional Policy Funds. The theoretical model of this thesis is the Solow neoclassical growth model, while also the core-periphery model is discussed. According to the Solow model the investments of the Regional Policy Funds lead to more production and therefore to more income. While the Solow model focuses on the why of the economic growth of regions, the core-periphery model focuses on the why of the clustering of economic activity in regions. In the core-periphery model the Regional Policy Funds are a dispersion force to stimulate firms to move to poor EU regions.

The second sub-research question was: 'To what extent have the Regional Policy Funds shown to be effective in causing convergence of EU NUTS-II regions?'. The results of the literature on the effect of the Regional Policy Funds are ambiguous. Most articles do find a somewhat positive effect of the Funds. In some research this positive effect does however depend on certain conditions, like the quality of institutions in a country. A couple of studies find no effect or even a negative effect of the Regional Policy Funds. Similar ambiguity of results is found in articles that use spatial econometric techniques.

The third sub-research question was: 'To what extent does proximity between regions influence their extent of convergence?'. Spatial spillover effects are an important issue in this thesis. The Regional Policy Funds do not only influence the region to which they are paid. Also surrounding regions are impacted by the Funds. These spatial spillover effects are taken into account by using a spatial weight matrix in the regression analysis. A spatial weight matrix shows the extent of proximity between regions. Proximity can be geographical proximity. The matrix than shows the distance between the

centroids of regions. In this thesis also three other measures of proximity are used: whether regions border each other or not, the extent to which regions are equal in institutional quality and the extent to which regions are equal in internet access. In the results the regression with the geographical proximity spatial weight matrix turns out to be the best fitting model. The regressions with the institutional quality and the internet access spatial weight matrix do however show similar results. Several types of proximity between regions thus influence their extent of convergence.

The results show that poor regions had on average higher economic growth than rich regions during the budget period 2007-2013. Convergence is thus taking place. There is no clear evidence of a significant effect of Regional Policy Funds on economic growth. The shown convergence can thus not be attributed to the Regional Policy Funds. The first hypothesis of this thesis that Regional Policy Funds have a positive effect on the economic growth of regions is thus not confirmed. The Regional Policy Funds do sometimes even have a negative effect on the growth of the highest earners of the Funds. The goal of the Regional Policy Funds, convergence, is thus reached, but this is not due to the Regional Policy Funds. The second hypothesis of this thesis that Regional Policy Funds lead to convergence of EU regions is thus also not confirmed. An explanation for this is the positive correlation in the results between the income of the regions at the beginning of the budget period and the heights of their Regional Policy Funds receipts. This finding contrasts the idea that the poorest regions of the EU need most help. The results also show a negative correlation between the economic growth of the regions and the amount of Funds received.

The data analysis was the most important challenge of this thesis. Three points are described to improve the data analysis. First, for some variables no data were available for some years or some regions. Over the coming years more data will become available. This will improve the precision of the analysis. Second, data about allocated Funds, not about paid out Funds are used in this thesis. Using still to become available data about paid out Funds will improve the precision of the analysis. Data about paid out Funds will also make it possible to use year data. Instead of a cross-sectional analysis the analysis will then be a panel data analysis. Third, investments might take some years to have full effect. This can be taken into account in the analysis by including lags. For this thesis however only GDP data until and including 2013 were however available, so including lags was not possible. A new research with these three points adapted is the most important opportunity to improve this thesis.

Answering the main research question ‘To what extent did the Regional Policy Funds in the budget period 2007-2013 lead to convergence of EU NUTS-II regions?’ this thesis shows no evidence that the Regional Policy Funds have led to convergence of EU regions in the budget period 2007-2013. A change in division of the Regional Policy Funds might lead to a stronger effect of the Regional Policy Funds. As

the Regional Policy Funds are a highly political instrument, the EU policymakers will not have an easy challenge improving the EU Regional Policy.

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See Appendix A for a list of sources of variables used.

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Appendices

A. Sources of variables used

Gross Domestic Product in 2013 in PPS per capita (GDP 2013)

Eurostat (2015). *GDP per capita in the EU in 2013: seven capital regions among the ten most prosperous*, news release May 21, 2015, online available at http://ec.europa.eu/eurostat/en/web/products-press-releases/-/1-21052015-AP, data obtained at October 13, 2015.

Gross Domestic Product in 2007 in PPS per capita (GDP 2007)

Eurostat (2015). *Gross domestic product (GDP) at current market prices by NUTS 2 regions*, online available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_r_e2gdp&lang=en, data obtained at October 13, 2015.

Average gross fixed capital formation as percentage GDP 2007-2011 (Investment)

Eurostat (2015). *Gross fixed capital formation by NUTS 2 regions*, online available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10r_2gfcf&lang=en, data obtained at October 20, 2015.

Average yearly growth population 2007-2013 in percentage (Population growth)

Eurostat (2015). *Population on 1 January by age, sex and NUTS 2 region*, online available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_r_d2jan&lang=en, data obtained at October 12, 2015.

Average human resources in science and technology as percentage of active population 2007-2013 (Human capital)

Eurostat (2015). *Human resources in science and technology (HRST) by NUTS 2 regions*, online available at http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tgs00038 &plugin=1, data obtained at October 19, 2015.

Allocated Regional Policy Funds 2007-2013 (Funds)

Document of European Commission received upon request at September 17, 2015.

Average share of employment in agriculture 2007-2013 (excluding 2009) in percentage (Employment agriculture)

Eurostat (2015). *Employment by age, economic activity and NUTS 2 regions (1999-2008, NACE Rev. 1.1)*, online available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfst_r_lfe2en1&lang=en (Data for years 2007 and 2008), data obtained at October 20, 2015.

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*Average long term unemployment (>12 months) 2007-2013 in percentage of active population (Unemployment)**

Eurostat (2015). *Long term unemployment (12 months and more) by NUTS 2 regions*, online available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfst_r_lfu2ltu&lang=en, data obtained at October 19, 2015.

Average population density per square kilometer 2007-2013 (Population density)

Eurostat (2015). *Total and land area by NUTS 2 region*, online available at http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tgs00002&language=en, data obtained at October 12, 2015.

X and Y coordinates per region (X_COORD and Y_COORD)

ETIS (2015). *2010 regions*, online available at ttp://www.etisplus.eu/data/Public/Downloads.aspx, data obtained at September 14, 2015.

Institutional quality in 2013 (INSTIQUA)

Quality of Government Institute (2015). *QoG EU Regional Data*, online available at http://qog.pol.gu.se/data/datadownloads/qogeuregionaldata, data obtained at October 6, 2015.

Percentage households with access to internet at home in 2014 (INTERNET)

Eurostat (2015). *Households with access to the internet at home*, online available at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_r_iacc_h&lang=en, data obtained at October 20, 2015.

B. List of regions not used

243 of the 272 NUTS-II regions (2006 classification) in the European Union are included in the dataset. The other 29 regions are excluded for three reasons.

10 regions are excluded for being an oversea region or being an enclave. The big distances between these regions and the other EU regions would disturb the spatial analysis: Guadeloupe (FR91), Martinique (FR92), Guyane (FR93), Reunion (FR94), Região Autónoma dos Açores (PT20), Região Autónoma da Madeira (PT30), Canarias (ES70), Ceuta (ES63), Melilla (ES64) and Gibraltar (GI).

7 regions are excluded because of a reclassification of NUTS-II regions during the budget period 2007-2013: Brandenburg-Nordost (DE41), Brandenburg-Südwest (DE42), Chemnitz (DED1), Leipzig (DED3), Itä-Suomi (FI13), Etelä-Suomi (FI18) and Pohjois-Suomi (FI1A). These regions are shown grey at the map below.

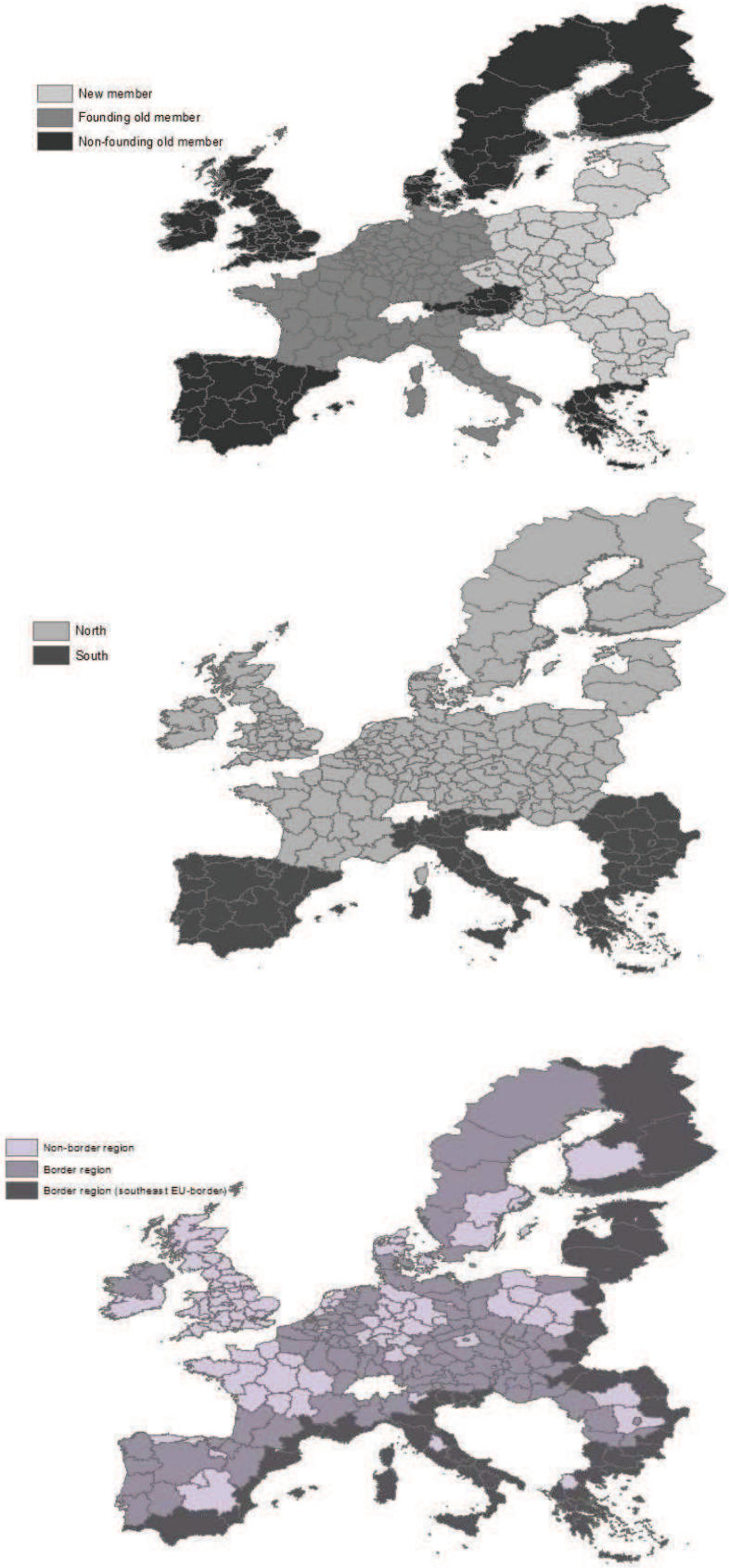
12 regions are excluded because of a lack of available data on either the investment variable or the control variables share of employment in agriculture and long term unemployment: Région de Bruxelles-Capitale / Brussels Hoofdstedelijk Gewest (BE10), Bremen (DE50), Saarland (DEC0), Corse (FR83), Cyprus (CY00), Burgenland (AT11), Salzburg (AT32), Tirol (AT33), Voralberg (AT34), Åland (FI20), Inner London (UKI1) and North Eastern Scotland (UKM5). These regions are shown black at the map below.

Figure A1: Regions excluded in the dataset of the regression

Source: own work author

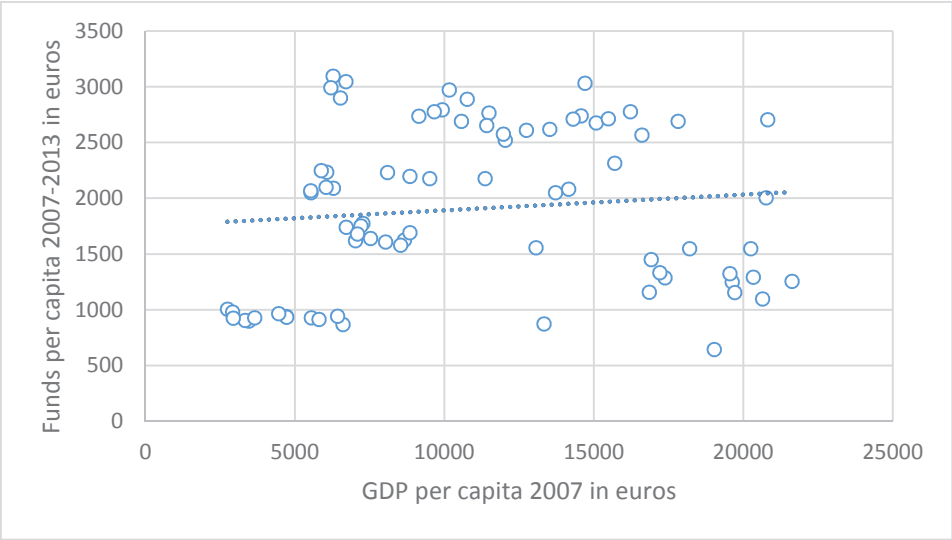
C. Figures and tables

Figure A2. Maps for regression variations



Source: own work author

Figure A3: Correlation GDP per capita 2007 and Funds per capita Objective 1 regions (n = 77)



Source: own work author based on data Eurostat (2015) and European Commission (2015)

Table A1: Coefficients country dummies Table A2

D_Belgium	-0.0529	D_Luxem-	-0.0524
	(0.157)	burg	(0.0460)
D_Bulgaria	-0.987	D_Hungary	-0.279
	(1.793)		(0.428)
D_Czech	-0.590**	D_Malta	0.119*
Republic	(0.290)		(0.0633)
D_Germany	1.283**	D_Nether-	0.291
	(0.646)	lands	(0.609)
D_Denmark	0.0932	D_Austria	0.0918
	(0.121)		(0.286)
D_Estonia	0.0208	D_Poland	0.363
	(0.0591)		(0.655)
D_Ireland	0.164	D_Portugal	-0.170
	(0.156)		(0.205)
D_Greece	-0.265	D_Romania	1.439
	(0.234)		(3.653)
D_Spain	-0.0150	D_Slovenia	-10.92***
	(0.139)		(3.081)
D_France	0.271	D_Slovakia	-0.459
	(0.209)		(0.715)
D_Italy	0.141	D_Finland	-0.0665**
	(0.146)		(0.0292)
D_Latvia	0.0939	D_United	-0.0213
	(0.0614)	Kingdom	(0.123)
D_Lithuania	0.124**		
	(0.0620)		

Table A2: Classic analysis including interaction variables

VARIABLES	(1) lnGDPDIF	(2) lnGDPDIF	(3) lnGDPDIF	(4) lnGDPDIF	(5) lnGDPDIF		(6) lnGDPDIF	(7) lnGDPDIF	(8) lnGDPDIF
GDP 2007	-0.130***	-0.0697**	-0.0892***	-0.0179	-0.0222		-0.159***	-0.158***	-0.0324
	(0.0325)	(0.0298)	(0.0286)	(0.0311)	(0.0450)		(0.0288)	(0.0317)	(0.0308)
Investment	0.0351	0.0442	0.0216	0.0392	-0.0323		0.0297	0.0483	0.00784
	(0.0320)	(0.0296)	(0.0308)	(0.0292)	(0.0342)		(0.0345)	(0.0361)	(0.0300)
Population	-0.364***	-0.372***	-0.276***	-0.307***	-0.0455		-0.349***	-0.393***	-0.232***
growth	(0.0576)	(0.0552)	(0.0516)	(0.0540)	(0.0488)		(0.0585)	(0.0601)	(0.0524)
Human	0.207***	0.170***	0.142***	0.105**	0.126***		0.202***	0.206***	0.0799**
capital	(0.0425)	(0.0413)	(0.0371)	(0.0447)	(0.0354)		(0.0409)	(0.0442)	(0.0393)
Funds (F)	0.00243	-0.0215**	-0.00349	0.0331***	0.0169		0.00554	0.0131*	-0.0142
	(0.0130)	(0.00970)	(0.0107)	(0.00769)	(0.0217)		(0.00999)	(0.00770)	(0.0132)
D_Objective 1	0.409**								0.848***
region	(0.189)								(0.251)
D_Objective 1	-0.0467*								-0.107***
region x Funds	(0.0261)								(0.0342)
D_New region		0.170	0.248						0.0948
		(0.156)	(0.186)						(0.310)
D_New region x		-0.00276	-0.0217						-0.000926
Funds		(0.0217)	(0.0254)						(0.0422)
D_Second			-0.0449						-0.117*
generation			(0.0619)						(0.0667)
D_Second			-0.00462						0.0114
gener. x Funds			(0.0113)						(0.0124)
D_Southern				0.363***					0.103
region				(0.0749)					(0.0820)
D_Southern				-0.0749***					-0.0238
region x Funds				(0.0128)					(0.0146)
D_Southern				0.945					0.0980
x D_New				(0.574)					(0.762)
D_Southern				-0.110					-0.0187
x D_New x F				(0.0818)					(0.107)
D_Belgium x F					0.0212	(0.0303)			
D_Bulgaria x F					0.163	(0.263)			
D_Czech R. x F					0.0750*	(0.0389)			
D_Germany x F					-0.263*	(0.134)			
D_Denmark x F					-0.000610	(0.0226)			
D_Ireland x F					-0.0502**	(0.0253)			
D_Greece x F					0.0119	(0.0353)			
D_Spain x F					-0.00749	(0.0247)			
D_France x F					-0.0501	(0.0399)			
D_Italy x F					-0.0260	(0.0269)			
D_Hungary x F					0.0463	(0.0601)			
D_Netherl. x F					-0.0639	(0.130)			
D_Austria x F					-0.00685	(0.0537)			
D_Poland x F					-0.0209	(0.0903)			
D_Portugal x F					0.0307	(0.0305)			
D_Romania x F					-0.169	(0.535)			
D_Slovenia x F					1.422***	(0.407)			
D_Slovakia x F					0.0785	(0.0972)			
D_UK x F					-0.00942	(0.0232)			
D_Border							0.0165		-0.0279
region							(0.0568)		(0.0599)
D_Border							0.00502		0.00921
region x Funds							(0.0102)		(0.0107)
D_EU Border								0.00895	-0.00837
region								(0.0132)	(0.0102)
D_EU Border								0.00348	0.00184
region x Funds								(0.00376)	(0.00292)
Employment	0.00592	0.0110	0.00222	0.0345***	0.00313		0.0130	0.00724	0.0115
agriculture	(0.0123)	(0.0111)	(0.0110)	(0.0116)	(0.0104)		(0.0126)	(0.0128)	(0.0114)
Unemploy-	-0.0785***	-0.0416***	-0.0539***	-0.0367***	-0.0266*		-0.0764***	-0.0842***	-0.0416***
ment	(0.0118)	(0.0127)	(0.0127)	(0.0131)	(0.0148)		(0.0121)	(0.0124)	(0.0126)
Population	0.0190***	0.0121*	0.00671	0.0282***	-0.00246		0.0284***	0.0248***	0.0117
Density	(0.00713)	(0.00705)	(0.00726)	(0.00660)	(0.00778)		(0.00694)	(0.00716)	(0.00775)
Constant	0.493	-0.0411	0.361	-0.817**	0.135		0.735*	0.631	-0.165
	(0.447)	(0.411)	(0.385)	(0.395)	(0.512)		(0.412)	(0.455)	(0.379)
R-squared	0.528	0.599	0.654	0.616	0.897		0.541	0.511	0.701
AIC	-513.95	-553.17	-585.52	-559.76	-820.11		-520.40	-505.09	-600.91
Observations	243	243	243	243	243		243	243	243

Robust standard errors in parentheses | *** p<0.01, ** p<0.05, * p<0.1 | Coefficients country dummies in Table A1

Table A3: Spatial analysis with geographical distance matrix including interaction variables (n = 243)

	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.107***	-0.105***	-0.102***	-0.0470*	-0.0221		-0.130***	-0.133***	-0.0569**
	(0.0210)	(0.0225)	(0.0240)	(0.0271)	(0.0268)		(0.0202)	(0.0203)	(0.0286)
Investment	0.00746	0.0231	0.0177	0.0254	-0.0314		0.0174	0.0236	0.00482
	(0.0234)	(0.0226)	(0.0234)	(0.0255)	(0.0235)		(0.0232)	(0.0231)	(0.0258)
Population	-0.185***	-0.209***	-0.222***	-0.237***	-0.0378		-0.201***	-0.217***	-0.189***
growth	(0.0461)	(0.0462)	(0.0477)	(0.0492)	(0.0447)		(0.0467)	(0.0470)	(0.0499)
Human	0.142***	0.138***	0.135***	0.110***	0.124***		0.142***	0.145***	0.0853***
Capital	(0.0285)	(0.0290)	(0.0299)	(0.0347)	(0.0283)		(0.0292)	(0.0296)	(0.0331)
Funds (F)	-0.00955	-0.0158**	-0.00698	0.0173***	0.0150		-0.0122*	-0.00698	-0.0187
	(0.00853)	(0.00723)	(0.0102)	(0.00651)	(0.0227)		(0.00716)	(0.00577)	(0.0122)
D_Objective 1	0.451***								0.778***
Region	(0.146)								(0.229)
D_Objective 1	-0.0557***								-0.0990***
region x Funds	(0.0199)								(0.0310)
D_New region		0.268**	0.271**						0.142
		(0.123)	(0.128)						(0.187)
D_New region x		-0.0291*	-0.0340						-0.0113
Funds		(0.0172)	(0.0616)						(0.0264)
D_Second			-0.0288						-0.108*
Generation			(0.0184)						(0.0640)
D_Second			-0.00234						0.0132
gener. x Funds			(0.0110)						(0.0116)
D_Southern				0.247***					0.0927
region				(0.0620)					(0.0798)
D_Southern				-0.0507***					-0.0204
region x Funds				(0.0101)					(0.0140)
D_Southern				0.769*					-0.128
x D_New				(0.416)					(0.482)
D_Southern				-0.0917					0.0138
x D_New x F				(0.0587)					(0.0668)
D_Belgium x F					0.0216	(0.0363)			
D_Bulgaria x F					0.232	(0.339)			
D_Czech R. x F					0.0804	(0.0570)			
D_Germany x F					-0.239	(0.301)			
D_Denmark x F					0.00244	(0.0238)			
D_Ireland x F					-0.0487	(0.0414)			
D_Greece x F					0.0152	(0.0371)			
D_Spain x F					-0.00527	(0.0258)			
D_France x F					-0.0491	(0.0399)			
D_Italy x F					-0.0265	(0.0251)			
D_Hungary x F					0.0478	(0.0704)			
D_Netherl. x F					-0.0576	(0.0568)			
D_Austria x F					-0.0174	(0.0878)			
D_Poland x F					-0.0137	(0.0868)			
D_Portugal x F					0.0318	(0.0319)			
D_Romania x F					-0.167	(0.589)			
D_Slovenia x F					1.494	(1.445)			
D_Slovakia x F					0.0908	(0.132)			
D_UK x F					-0.00801	(0.0238)			
D_Border							-0.0206		-0.0530
region							(0.0453)		(0.0484)
D_Border							0.00655		0.0124
region x Funds							(0.00754)		(0.00815)
D_EU Border								0.00367	-0.00624
region								(0.0103)	(0.0101)
D_EU Border								0.000703	0.000762
region x Funds								(0.00274)	(0.00269)
Employment	0.00175	0.00275	0.000686	0.0238***	0.00277		0.00684	0.00325	0.00879
agriculture	(0.00826)	(0.00833)	(0.00867)	(0.00896)	(0.00847)		(0.00870)	(0.00850)	(0.00944)
Unemploy-	-0.0434***	-0.0336***	-0.0456***	-0.0322***	-0.0257**		-0.0438***	-0.0466***	-0.0373***
ment	(0.00900)	(0.00999)	(0.0103)	(0.0109)	(0.0108)		(0.00907)	(0.00899)	(0.0109)
Population	0.0130**	0.0124**	0.00863	0.0228***	-0.00287		0.0194***	0.0173***	0.0127**
density	(0.00565)	(0.00564)	(0.00580)	(0.00575)	(0.00580)		(0.00567)	(0.00561)	(0.00618)
Constant	0.651**	0.610*	0.578*	-0.274	0.201		0.824***	0.818***	0.174
	(0.298)	(0.313)	(0.344)	(0.354)	(0.351)		(0.301)	(0.307)	(0.365)
Lambda	1.862***	1.768***	0.930***	0.950***	-0.398		1.835***	1.861***	0.902***
	(0.0876)	(0.134)	(0.0662)	(0.0465)	(0.297)		(0.104)	(0.0883)	(0.0891)
Sigma2	0.00392***	0.00392***	0.00401***	0.00422***	0.00139***		0.00406***	0.00413***	0.00358***
	(0.000357)	(0.000356)	(0.000365)	(0.000384)	(0.000126)		(0.000369)	(0.000375)	(0.000326)

Table A4: Spatial analysis with geographical distance matrix excluding interaction variables

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.136***	-0.117***	-0.0848***	-0.0962***	-0.106***	-0.0318		-0.135***	-0.135***	-0.0737***
	(0.0195)	(0.0210)	(0.0231)	(0.0225)	(0.0246)	(0.0251)		(0.0194)	(0.0197)	(0.0262)
Investment	0.0233	0.0247	0.0329	0.0178	0.0289	-0.0326		0.0164	0.0236	0.0248
	(0.0231)	(0.0229)	(0.0237)	(0.0232)	(0.0245)	(0.0206)		(0.0232)	(0.0231)	(0.0247)
Population	-0.216***	-0.212***	-0.288***	-0.231***	-0.195***	-0.0426		-0.202***	-0.219***	-0.227***
growth	(0.0462)	(0.0459)	(0.0468)	(0.0473)	(0.0477)	(0.0429)		(0.0468)	(0.0467)	(0.0494)
Human	0.147***	0.144***	0.150***	0.132***	0.125***	0.123***		0.144***	0.146***	0.113***
capital	(0.0292)	(0.0290)	(0.0303)	(0.0296)	(0.0337)	(0.0278)		(0.0292)	(0.0294)	(0.0331)
Funds	-0.00712	-0.0194**	-0.0208***	-0.0127*	-0.00631	0.00597		-0.00854	-0.00697	-0.0262***
	(0.00575)	(0.00789)	(0.00715)	(0.00716)	(0.00577)	(0.00629)		(0.00579)	(0.00577)	(0.00940)
D_Objective		0.0455**								0.0447**
1 region		(0.0201)								(0.0203)
D_New			0.101***	0.0696***						0.0660***
region			(0.0181)	(0.0191)						(0.0208)
D_Second				-0.0447***						-0.0379***
generation				(0.0105)						(0.0107)
D_Southern					-0.0268					-0.0136
region					(0.0166)					(0.0170)
D_Southern					0.0495*					-0.00383
x D_New x F					(0.0253)					(0.0280)
D_Belgium						0.0571**	(0.0235)			
D_Bulgaria						0.134***	(0.0296)			
D_Czech R.						0.0264	(0.0270)			
D_Germany						0.0257	(0.0246)			
D_Denmark						0.0914***	(0.0204)			
D_Estonia						0.0456	(0.0439)			
D_Ireland						-0.118***	(0.0411)			
D_Greece						-0.161***	(0.0324)			
D_Spain						-0.0624**	(0.0297)			
D_France						0.00131	(0.0230)			
D_Italy						-0.00713	(0.0238)			
D_Latvia						0.119**	(0.0468)			
D_Lithuania						0.153***	(0.0476)			
D_Luxemb.						-0.0488	(0.0471)			
D_Hungary						0.112***	(0.0277)			
D_Matla						0.140***	(0.0485)			
D_Netherl.						-0.0168	(0.0241)			
D_Austria						0.0622**	(0.0270)			
D_Poland						0.236***	(0.0280)			
D_Portugal						0.0651*	(0.0338)			
D_Romania						0.303***	(0.0343)			
D_Slovenia						-0.0565	(0.0354)			
D_Slovakia						0.165***	(0.0294)			
D_Finland						-0.0562	(0.0444)			
D_UK						-0.0836***	(0.0264)			
D_Border								0.0180**		0.0161*
Regions								(0.00909)		(0.00927)
D_EU Border									0.00385	0.000376
Regions									(0.0103)	(0.0103)
Employment	0.00377	0.00167	0.00784	0.00268	0.00667	-0.000436		0.00479	0.00344	0.00316
Agriculture	(0.00842)	(0.00839)	(0.00864)	(0.00843)	(0.00852)	(0.00805)		(0.00838)	(0.00847)	(0.00861)
Unemploy-	-0.0466***	-0.0420***	-0.0360***	-0.0432***	-0.0361***	-0.0241**		-0.0442***	-0.0467***	-0.0347***
Ment	(0.00898)	(0.00915)	(0.0104)	(0.0102)	(0.0104)	(0.00999)		(0.00907)	(0.00899)	(0.0110)
Population	0.0173***	0.0140**	0.0124**	0.00883	0.0168***	-0.00561		0.0186***	0.0174***	0.00897
Density	(0.00560)	(0.00574)	(0.00593)	(0.00579)	(0.00566)	(0.00530)		(0.00561)	(0.00561)	(0.00599)
Constant	0.846***	0.744**	0.264	0.515	0.584*	0.328		0.858***	0.826***	0.346
	(0.301)	(0.301)	(0.322)	(0.317)	(0.330)	(0.330)		(0.299)	(0.305)	(0.341)
Lambda	1.863***	1.854***	0.954***	0.925***	1.841***	-0.216		1.834***	1.863***	0.912***
	(0.0870)	(0.0925)	(0.0424)	(0.0701)	(0.100)	(0.289)		(0.104)	(0.0875)	(0.0819)
Sigma2	0.00413***	0.00405***	0.00434***	0.00405***	0.00407***	0.00152***		0.00407***	0.00413***	0.00392***
	(0.000376)	(0.000368)	(0.000395)	(0.000369)	(0.000370)	(0.000137)		(0.000370)	(0.000376)	(0.000357)
Observations	243	243	243	243	243	243		243	243	243
Standard errors in parentheses				*** p<0.01, ** p<0.05, * p<0.1						

Table A5: Coefficients country dummies Table 8

D_Belgium	-0.0628	D_Luxem-	-0.0593
	(0.192)	burg	(0.0476)
D_Bulgaria	-1.455	D_Hungary	-0.279
	(2.311)		(0.537)
D_Czech	-0.622	D_Malta	0.109
Republic	(0.432)		(0.0723)
D_Germany	1.168	D_Nether-	0.254
	(1.435)	lands	(0.279)
D_Denmark	0.0772	D_Austria	0.148
	(0.127)		(0.457)
D_Estonia	0.0301	D_Poland	0.326
	(0.0703)		(0.634)
D_Ireland	0.133	D_Portugal	-0.195
	(0.231)		(0.208)
D_Greece	-0.306	D_Romania	1.436
	(0.254)		(4.020)
D_Spain	-0.0491	D_Slovenia	-11.47
	(0.146)		(11.01)
D_France	0.252	D_Slovakia	-0.540
	(0.210)		(0.997)
D_Italy	0.134	D_Finland	-0.0629
	(0.134)		(0.0438)
D_Latvia	0.107	D_United	-0.0542
	(0.0694)	Kingdom	(0.128)
D_Lithuania	0.140**		
	(0.0705)		

Table A6: Coefficients country dummies Table 9

D_Belgium	-0.0437	D_Luxem-	-0.0514
	(0.192)	burg	(0.0474)
D_Bulgaria	-1.207	D_Hungary	-0.289
	(2.295)		(0.538)
D_Czech	-0.552	D_Malta	0.123*
Republic	(0.433)		(0.0720)
D_Germany	1.437	D_Nether-	0.294
	(1.440)	lands	(0.278)
D_Denmark	0.100	D_Austria	0.160
	(0.127)		(0.459)
D_Estonia	0.0201	D_Poland	0.349
	(0.0701)		(0.634)
D_Ireland	0.163	D_Portugal	-0.186
	(0.230)		(0.208)
D_Greece	-0.237	D_Romania	1.303
	(0.254)		(4.027)
D_Spain	-0.00646	D_Slovenia	-9.851
	(0.145)		(11.05)
D_France	0.290	D_Slovakia	-0.459
	(0.210)		(0.996)
D_Italy	0.145	D_Finland	-0.0678
	(0.134)		(0.0438)
D_Latvia	0.0966	D_United	-0.0203
	(0.0688)	Kingdom	(0.126)
D_Lithuania	0.126*		
	(0.0696)		

Table A7: Spatial analysis with adjacency matrix including interaction variables (n = 243)

	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.111***	-0.0658**	-0.0858***	-0.0151	-0.0246		-0.142***	-0.137***	-0.0302
	(0.0268)	(0.0263)	(0.0260)	(0.0299)	(0.0269)		(0.0252)	(0.0258)	(0.0303)
Investment	0.0285	0.0397	0.0185	0.0349	-0.0328		0.0234	0.0391	0.00676
	(0.0292)	(0.0266)	(0.0254)	(0.0282)	(0.0235)		(0.0284)	(0.0287)	(0.0274)
Population	-0.346***	-0.362***	-0.270***	-0.301***	-0.0437		-0.334***	-0.371***	-0.230***
growth	(0.0569)	(0.0527)	(0.0515)	(0.0543)	(0.0444)		(0.0562)	(0.0577)	(0.0529)
Human	0.197***	0.167***	0.141***	0.103***	0.130***		0.193***	0.194***	0.0789**
Capital	(0.0356)	(0.0340)	(0.0324)	(0.0383)	(0.0285)		(0.0354)	(0.0367)	(0.0352)
Funds (F)	0.00395	-0.0176**	-0.000630	0.0340***	0.0161		0.00885	0.0164**	-0.0123
	(0.0106)	(0.00877)	(0.0112)	(0.00715)	(0.0227)		(0.00871)	(0.00711)	(0.0130)
D_Objective 1	0.354*								0.821***
Region	(0.184)								(0.244)
D_Objective 1	-0.0390								-0.104***
region x Funds	(0.0250)								(0.0331)
D_New region		0.160	0.240*						0.108
		(0.144)	(0.139)						(0.199)
D_New region x		-0.00275	-0.0215						-0.00361
Funds		(0.0200)	(0.0199)						(0.0282)
D_Second			-0.0431						-0.116*
generation			(0.0665)						(0.0681)
D_Second			-0.00473						0.0113
gener. x Funds			(0.0119)						(0.0123)
D_Southern				0.345***					0.106
Region				(0.0686)					(0.0849)
D_Southern				-0.0711***					-0.0241
region x Funds				(0.0112)					(0.0149)
D_Southern				0.926**					0.0907
x D_New				(0.459)					(0.512)
D_Southern				-0.110*					-0.0180
x D_New x F				(0.0647)					(0.0709)
D_Belgium x F					0.0197	(0.0364)			
D_Bulgaria x F					0.196	(0.337)			
D_Czech R. x F					0.0708	(0.0571)			
D_Germany x F					-0.295	(0.302)			
D_Denmark x F					-0.00150	(0.0238)			
D_Ireland x F					-0.0500	(0.0415)			
D_Greece x F					0.00785	(0.0373)			
D_Spain x F					-0.00882	(0.0258)			
D_France x F					-0.0534	(0.0400)			
D_Italy x F					-0.0266	(0.0251)			
D_Hungary x F					0.0478	(0.0705)			
D_Netherl. x F					-0.0643	(0.0567)			
D_Austria x F					-0.0191	(0.0882)			
D_Poland x F					-0.0185	(0.0867)			
D_Portugal x F					0.0333	(0.0320)			
D_Romania x F					-0.148	(0.591)			
D_Slovenia x F					1.282	(1.451)			
D_Slovakia x F					0.0791	(0.132)			
D_UK x F					-0.00959	(0.0238)			
D_Border							0.0135		-0.0297
region							(0.0552)		(0.0514)
D_Border							0.00483		0.00931
region x Funds							(0.00919)		(0.00867)
D_EU Border								0.0108	-0.00746
region								(0.0128)	(0.0108)
D_EU Border								0.00361	0.00192
region x Funds								(0.00338)	(0.00286)
Employment	0.00628	0.0111	0.00245	0.0334***	0.00355		0.0131	0.00749	0.0112
agriculture	(0.0103)	(0.00976)	(0.00937)	(0.00989)	(0.00849)		(0.0106)	(0.0105)	(0.0100)
Unemploy-	-0.0739***	-0.0422***	-0.0542***	-0.0372***	-0.0259**		-0.0733***	-0.0797***	-0.0421***
ment	(0.0112)	(0.0117)	(0.0111)	(0.0120)	(0.0108)		(0.0109)	(0.0110)	(0.0116)
Population	0.0183***	0.0125*	0.00713	0.0278***	-0.00284		0.0274***	0.0240***	0.0119*
density	(0.00706)	(0.00663)	(0.00627)	(0.00635)	(0.00580)		(0.00689)	(0.00693)	(0.00657)
Constant	0.317	-0.0879	0.315	-0.845**	0.175		0.566	0.425	-0.198
	(0.376)	(0.364)	(0.373)	(0.389)	(0.350)		(0.371)	(0.385)	(0.387)
Lambda	0.0471***	0.0244*	0.0192	0.0299**	-0.0103		0.0418***	0.0491***	0.0173
	(0.0143)	(0.0143)	(0.0135)	(0.0138)	(0.00886)		(0.0143)	(0.0144)	(0.0130)
Sigma2	0.00612***	0.00541***	0.00468***	0.00514***	0.00140***		0.00603***	0.00632***	0.00405***
	(0.000557)	(0.000491)	(0.000425)	(0.000467)	(0.000127)		(0.000548)	(0.000575)	(0.000368)

Table A8: Spatial analysis with adjacency matrix excluding interaction variables

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-.146***	-0.117***	-0.0652**	-0.0840***	-0.0841***	-0.0329		-0.146***	-0.143***	-0.0565**
	(0.0249)	(0.0266)	(0.0259)	(0.0244)	(0.0302)	(0.0252)		(0.0243)	(0.0251)	(0.0280)
Investment	0.0383	0.0401	0.0398	0.0174	0.0678**	-0.0327		0.0226	0.0393	0.0312
	(0.0288)	(0.0284)	(0.0266)	(0.0251)	(0.0299)	(0.0206)		(0.0283)	(0.0288)	(0.0264)
Population	-0.372***	-0.364***	-0.363***	-0.275***	-0.345***	-0.0464		-0.334***	-0.379***	-0.278***
growth	(0.0569)	(0.0561)	(0.0524)	(0.0510)	(0.0574)	(0.0425)		(0.0562)	(0.0573)	(0.0524)
Human	0.203***	0.198***	0.167***	0.140***	0.131***	0.126***		0.194***	0.200***	0.109***
capital	(0.0363)	(0.0358)	(0.0339)	(0.0319)	(0.0411)	(0.0279)		(0.0354)	(0.0364)	(0.0354)
Funds	0.0160**	-0.00292	-0.0180**	-0.00647	0.0154**	0.00502		0.0116	0.0165**	-0.0245**
	(0.00712)	(0.00975)	(0.00830)	(0.00797)	(0.00698)	(0.00639)		(0.00703)	(0.00713)	(0.0101)
D_Objective		0.0695***								0.0533**
1 region		(0.0248)								(0.0217)
D_New			0.140***	0.0921***						0.0922***
region			(0.0208)	(0.0210)						(0.0223)
D_Second				-0.0676***						-0.0571***
generation				(0.0111)						(0.0113)
D_Southern					-0.0727***					-0.0199
region					(0.0200)					(0.0182)
D_Southern					0.0752**					-0.0197
x D_New x F					(0.0314)					(0.0300)
D_Belgium						0.0623***	(0.0229)			
D_Bulgaria						0.139***	(0.0301)			
D_Czech R.						0.0280	(0.0270)			
D_Germany						0.0280	(0.0246)			
D_Denmark						0.0931***	(0.0205)			
D_Estonia						0.0437	(0.0437)			
D_Ireland						-0.105***	(0.0377)			
D_Greece						-0.151***	(0.0296)			
D_Spain						-0.0501*	(0.0257)			
D_France						0.0101	(0.0208)			
D_Italy						-0.000724	(0.0227)			
D_Latvia						0.117**	(0.0464)			
D_Lithuania						0.149***	(0.0468)			
D_Luxemb.						-0.0450	(0.0469)			
D_Hungary						0.111***	(0.0272)			
D_Matla						0.151***	(0.0476)			
D_Netherl.						-0.0131	(0.0236)			
D_Austria						0.0650**	(0.0272)			
D_Poland						0.233***	(0.0267)			
D_Portugal						0.0794**	(0.0312)			
D_Romania						0.303***	(0.0337)			
D_Slovenia						-0.0504	(0.0358)			
D_Slovakia						0.164***	(0.0289)			
D_Finland						-0.0588	(0.0443)			
D_UK						-0.0698***	(0.0187)			
D_Border								0.0419***		0.0210**
Regions								(0.0110)		(0.00990)
D_EU Border									0.0117	-0.000110
Regions									(0.0128)	(0.0110)
Employment	0.00948	0.00622	0.0113	0.00335	0.0163	1.22e-05		0.0116	0.00848	0.00445
Agriculture	(0.0105)	(0.0104)	(0.00964)	(0.00909)	(0.0104)	(0.00803)		(0.0102)	(0.0105)	(0.00918)
Unemploy-	-0.0800***	-0.0726***	-0.0420***	-0.0525***	-0.0567***	-0.0243**		-0.0736***	-0.0801***	-0.0411***
Ment	(0.0110)	(0.0112)	(0.0116)	(0.0110)	(0.0127)	(0.00996)		(0.0109)	(0.0110)	(0.0117)
Population	0.0240***	0.0189***	0.0125*	0.00710	0.0253***	-0.00562		0.0269***	0.0242***	0.00817
Density	(0.00696)	(0.00708)	(0.00663)	(0.00625)	(0.00688)	(0.00529)		(0.00681)	(0.00695)	(0.00638)
Constant	0.533	0.375	-0.0954	0.309	-0.0549	0.320		0.592	0.471	0.0802
	(0.378)	(0.376)	(0.360)	(0.343)	(0.403)	(0.327)		(0.368)	(0.383)	(0.365)
Lambda	0.0483***	0.0491***	0.0244*	0.0192	0.0425***	-0.00887		0.0418***	0.0489***	0.0202
	(0.0144)	(0.0142)	(0.0143)	(0.0136)	(0.0144)	(0.00885)		(0.0143)	(0.0144)	(0.0134)
Sigma2	0.00638***	0.00618***	0.00541***	0.00470***	0.00606***	0.00151***		0.00603***	0.00635***	0.00445***
	(0.000580)	(0.000562)	(0.000491)	(0.000427)	(0.000551)	(0.000137)		(0.000548)	(0.000578)	(0.000404)
Observations	243	243	243	243	243	243		243	243	
Standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1							

Table A9: Spatial analysis with institutional quality matrix including interaction variables (n = 243)

	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.116***	-0.0781***	-0.0812***	-0.0361	-0.0219		-0.153***	-0.149***	-0.0255
	(0.0252)	(0.0257)	(0.0255)	(0.0280)	(0.0273)		(0.0241)	(0.0247)	(0.0290)
Investment	-0.0225	0.00244	0.00457	-0.00878	-0.0330		-0.00457	-0.00190	-0.00426
	(0.0258)	(0.0237)	(0.0237)	(0.0258)	(0.0236)		(0.0259)	(0.0259)	(0.0257)
Population	-0.229***	-0.269***	-0.250***	-0.201***	-0.0463		-0.253***	-0.272***	-0.216***
growth	(0.0538)	(0.0508)	(0.0500)	(0.0527)	(0.0462)		(0.0559)	(0.0556)	(0.0513)
Human	0.155***	0.140***	0.132***	0.103***	0.127***		0.170***	0.163***	0.0851***
capital	(0.0321)	(0.0309)	(0.0308)	(0.0336)	(0.0285)		(0.0332)	(0.0334)	(0.0320)
Funds (F)	0.00693	-0.00589	-0.000322	0.0327***	0.0171		0.00825	0.0151**	-0.0153
	(0.00942)	(0.00754)	(0.0103)	(0.00707)	(0.0237)		(0.00811)	(0.00681)	(0.0126)
D_Objective 1	0.667***								0.755***
region	(0.171)								(0.227)
D_Objective 1	-0.0820***								-0.0941***
region x Funds	(0.0231)								(0.0305)
D_New region		0.270**	0.308**						0.133
		(0.136)	(0.140)						(0.183)
D_New region x		-0.0198	-0.0284						-0.00525
Funds		(0.0192)	(0.0203)						(0.0262)
D_Second			-0.0390						-0.117*
generation			(0.0668)						(0.0666)
D_Second			-0.000604						0.0161
gener. x Funds			(0.0117)						(0.0119)
D_Southern				0.260***					0.117
region				(0.0688)					(0.0819)
D_Southern				-0.0556***					-0.0259*
region x Funds				(0.0112)					(0.0143)
D_Southern				0.905*					-0.158
x D_New				(0.515)					(0.559)
D_Southern				-0.105					0.0225
x D_New x F				(0.0739)					(0.0788)
D_Belgium x F					0.0182	(0.0383)			
D_Bulgaria x F					0.153	(0.338)			
D_Czech R. x F					0.0741	(0.0576)			
D_Germany x F					-0.268	(0.302)			
D_Denmark x F					-0.000942	(0.0248)			
D_Ireland x F					-0.0508	(0.0421)			
D_Greece x F					0.0117	(0.0374)			
D_Spain x F					-0.00807	(0.0268)			
D_France x F					-0.0516	(0.0407)			
D_Italy x F					-0.0271	(0.0262)			
D_Hungary x F					0.0445	(0.0715)			
D_Netherl. x F					-0.0674	(0.0576)			
D_Austria x F					-0.00680	(0.0879)			
D_Poland x F					-0.0220	(0.0870)			
D_Portugal x F					0.0299	(0.0328)			
D_Romania x F					-0.127	(0.590)			
D_Slovenia x F					1.411	(1.378)			
D_Slovakia x F					0.0715	(0.133)			
D_UK x F					-0.00807	(0.0250)			
D_Border							-0.0343		-0.0517
region							(0.0521)		(0.0496)
D_Border							0.00941		0.0109
region x Funds							(0.00860)		(0.00837)
D_EU Border								0.0115	0.00403
region								(0.0114)	(0.0102)
D_EU Border								0.00351	0.00198
region x Funds								(0.00275)	(0.00249)
Employment	0.0217**	0.0280***	0.0240**	0.0438***	0.00354		0.0274***	0.0231**	0.0288***
agriculture	(0.00963)	(0.00931)	(0.00952)	(0.00943)	(0.00862)		(0.0102)	(0.00999)	(0.00981)
Unemploy-	-0.0776***	-0.0450***	-0.0492***	-0.0339***	-0.0259**		-0.0787***	-0.0805***	-0.0377***
ment	(0.0101)	(0.0111)	(0.0110)	(0.0117)	(0.0109)		(0.0105)	(0.0105)	(0.0115)
Population	0.0225***	0.0226***	0.0214***	0.0316***	-0.00222		0.0317***	0.0295***	0.0223***
density	(0.00690)	(0.00654)	(0.00662)	(0.00644)	(0.00587)		(0.00708)	(0.00700)	(0.00669)
Constant	0.558	0.103	0.186	-0.430	0.127		0.847**	0.729*	-0.284
	(0.363)	(0.364)	(0.367)	(0.379)	(0.363)		(0.370)	(0.377)	(0.377)
Rho	0.590***	0.563***	0.513***	0.546***	0.0541		0.538***	0.559***	0.501***
	(0.0531)	(0.0568)	(0.0688)	(0.0589)	(0.114)		(0.0595)	(0.0554)	(0.0722)
Sigma2	0.00434***	0.00396***	0.00385***	0.00389***	0.00140***		0.00472***	0.00473***	0.00341***
	(0.000408)	(0.000372)	(0.000362)	(0.000365)	(0.000127)		(0.000442)	(0.000443)	(0.000320)

Table A10: Spatial analysis with institutional quality matrix excluding interaction variables

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.158***	-0.131***	-0.0726***	-0.0739***	-0.0691**	-0.0308		-0.157***	-0.155***	-0.0360
	(0.0241)	(0.0255)	(0.0252)	(0.0248)	(0.0288)	(0.0252)		(0.0240)	(0.0242)	(0.0278)
Investment	-0.00200	0.00352	0.00252	0.00436	0.00768	-0.0322		-0.00493	-0.000791	0.0170
	(0.0261)	(0.0257)	(0.0237)	(0.0234)	(0.0263)	(0.0206)		(0.0260)	(0.0260)	(0.0247)
Population	-0.274***	-0.267***	-0.275***	-0.259***	-0.212***	-0.0481		-0.259***	-0.278***	-0.245***
Growth	(0.0555)	(0.0546)	(0.0506)	(0.0498)	(0.0544)	(0.0439)		(0.0557)	(0.0556)	(0.0519)
Human	0.169***	0.158***	0.138***	0.129***	0.118***	0.124***		0.171***	0.167***	0.103***
Capital	(0.0334)	(0.0331)	(0.0309)	(0.0306)	(0.0349)	(0.0279)		(0.0333)	(0.0333)	(0.0329)
Funds	0.0146**	-0.00373	-0.00845	-0.00461	0.0149**	0.00628		0.0131*	0.0150**	-0.0188*
	(0.00684)	(0.00919)	(0.00716)	(0.00719)	(0.00657)	(0.00630)		(0.00684)	(0.00683)	(0.00979)
D_Objective		0.0637***								0.0533***
1 region		(0.0218)								(0.0200)
D_New			0.132***	0.110***						0.0984***
Region			(0.0188)	(0.0197)						(0.0225)
D_Second				-0.0402***						-0.0343***
generation				(0.0124)						(0.0122)
D_Southern					-0.0735***					-0.0252
Region					(0.0178)					(0.0180)
D_Southern					0.138***					0.0240
x D_New x F					(0.0291)					(0.0326)
D_Belgium						0.0610***	(0.0234)			
D_Bulgaria						0.132***	(0.0300)			
D_Czech R.						0.0222	(0.0269)			
D_Germany						0.0262	(0.0250)			
D_Denmark						0.0907***	(0.0210)			
D_Estonia						0.0419	(0.0440)			
D_Ireland						-0.106***	(0.0379)			
D_Greece						-0.151***	(0.0300)			
D_Spain						-0.0517**	(0.0260)			
D_France						0.00839	(0.0212)			
D_Italy						-0.00221	(0.0231)			
D_Latvia						0.113**	(0.0468)			
D_Lithuania						0.146***	(0.0471)			
D_Luxemb.						-0.0455	(0.0472)			
D_Hungary						0.107***	(0.0280)			
D_Matla						0.146***	(0.0480)			
D_Netherl.						-0.0139	(0.0241)			
D_Austria						0.0605**	(0.0274)			
D_Poland						0.228***	(0.0269)			
D_Portugal						0.0735**	(0.0318)			
D_Romania						0.296***	(0.0338)			
D_Slovenia						-0.0564	(0.0364)			
D_Slovakia						0.159***	(0.0290)			
D_Finland						-0.0587	(0.0445)			
D_UK						-0.0701***	(0.0193)			
D_Border								0.0216**		0.0104
Regions								(0.0106)		(0.00950)
D_EU Border									0.0126	0.0103
Regions									(0.0114)	(0.0104)
Employment	0.0237**	0.0207**	0.0289***	0.0253***	0.0344***	0.000126		0.0248**	0.0234**	0.0253***
Agriculture	(0.0100)	(0.00990)	(0.00930)	(0.00943)	(0.00970)	(0.00809)		(0.00999)	(0.0100)	(0.00943)
Unemploy-	-0.0821***	-0.0781***	-0.0433***	-0.0467***	-0.0474***	-0.0246**		-0.0788***	-0.0810***	-0.0360***
Ment	(0.0105)	(0.0104)	(0.0111)	(0.0109)	(0.0120)	(0.0100)		(0.0105)	(0.0105)	(0.0115)
Population	0.0290***	0.0247***	0.0225***	0.0211***	0.0274***	-0.00506		0.0305***	0.0296***	0.0201***
Density	(0.00702)	(0.00706)	(0.00656)	(0.00661)	(0.00672)	(0.00542)		(0.00701)	(0.00703)	(0.00658)
Constant	0.835**	0.691*	0.0398	0.102	0.0611	0.282		0.850**	0.786**	-0.182
	(0.374)	(0.371)	(0.360)	(0.356)	(0.387)	(0.329)		(0.371)	(0.375)	(0.367)
Rho	0.556***	0.562***	0.557***	0.504***	0.595***	0.0321		0.534***	0.557***	0.507***
	(0.0559)	(0.0556)	(0.0573)	(0.0696)	(0.0532)	(0.102)		(0.0600)	(0.0556)	(0.0703)
Sigma2	0.00479***	0.00462***	0.00399***	0.00390***	0.00426***	0.00152***		0.00475***	0.00477***	0.00371***
	(0.000449)	(0.000433)	(0.000374)	(0.000366)	(0.000401)	(0.000138)		(0.000445)	(0.000446)	(0.000348)
Observations	243	243	243	243	243	243		243	243	
Standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1							

Table A11: Coefficients country dummies Table 10

D_Belgium	-0.0376	D_Luxem	-0.0525
	(0.202)	burg	(0.0479)
D_Bulgaria	-0.922	D_Hungary	-0.267
	(2.305)		(0.543)
D_Czech	-0.584	D_Malta	0.117
Republic	(0.434)		(0.0740)
D_Germany	1.304	D_Nether-	0.308
	(1.442)	lands	(0.282)
D_Denmark	0.0940	D_Austria	0.0913
	(0.132)		(0.457)
D_Estonia	0.0191	D_Poland	0.370
	(0.0723)		(0.635)
D_Ireland	0.167	D_Portugal	-0.168
	(0.233)		(0.211)
D_Greece	-0.266	D_Romania	1.152
	(0.253)		(4.023)
D_Spain	-0.0126	D_Slovenia	-10.84
	(0.150)		(10.50)
D_France	0.279	D_Slovakia	-0.408
	(0.214)		(1.004)
D_Italy	0.147	D_Finland	-0.0672
	(0.140)		(0.0441)
D_Latvia	0.0921	D_United	-0.0287
	(0.0711)	Kingdom	(0.132)
D_Lithuania	0.124*		
	(0.0718)		

Table A12: Coefficients country dummies Table 11

D_Belgium	-0.0464	D_Luxem	-0.0512
	(0.193)	burg	(0.0476)
D_Bulgaria	-0.788	D_Hungary	-0.290
	(2.315)		(0.539)
D_Czech	-0.620	D_Malta	0.122*
Republic	(0.435)		(0.0722)
D_Germany	1.182	D_Nether-	0.289
	(1.446)	lands	(0.279)
D_Denmark	0.0877	D_Austria	0.0736
	(0.127)		(0.457)
D_Estonia	0.0215	D_Poland	0.393
	(0.0702)		(0.637)
D_Ireland	0.160	D_Portugal	-0.178
	(0.230)		(0.208)
D_Greece	-0.272	D_Romania	1.215
	(0.254)		(4.050)
D_Spain	-0.0230	D_Slovenia	-10.70
	(0.145)		(11.05)
D_France	0.263	D_Slovakia	-0.537
	(0.211)		(1.006)
D_Italy	0.136	D_Finland	-0.0662
	(0.135)		(0.0439)
D_Latvia	0.0939	D_United	-0.0225
	(0.0689)	Kingdom	(0.126)
D_Lithuania	0.127*		
	(0.0699)		

Table A13: Spatial analysis with internet access matrix including interaction variables (n = 243)

	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.0837***	-0.0428*	-0.0672***	0.00470	-0.0201		-0.110***	-0.105***	-0.0158
	(0.0251)	(0.0247)	(0.0249)	(0.0283)	(0.0271)		(0.0238)	(0.0242)	(0.0294)
Investment	0.0281	0.0352	0.0158	0.0308	-0.0312		0.0226	0.0368	0.00694
	(0.0270)	(0.0246)	(0.0240)	(0.0265)	(0.0237)		(0.0262)	(0.0264)	(0.0264)
Population	-0.342***	-0.347***	-0.269***	-0.287***	-0.0467		-0.329***	-0.361***	-0.229***
growth	(0.0525)	(0.0487)	(0.0487)	(0.0511)	(0.0445)		(0.0518)	(0.0530)	(0.0509)
Human	0.180***	0.154***	0.137***	0.101***	0.127***		0.176***	0.178***	0.0832**
capital	(0.0330)	(0.0316)	(0.0307)	(0.0360)	(0.0284)		(0.0328)	(0.0339)	(0.0339)
Funds (F)	0.00872	-0.00877	0.000446	0.0351***	0.0166		0.0132	0.0192***	-0.00943
	(0.00988)	(0.00813)	(0.0104)	(0.00672)	(0.0227)		(0.00806)	(0.00655)	(0.0125)
D_Objective 1	0.298*								0.653***
region	(0.170)								(0.239)
D_Objective 1	-0.0328								-0.0817**
region x Funds	(0.0231)								(0.0323)
D_New region		0.207	0.249*						0.110
		(0.134)	(0.131)						(0.191)
D_New region x		-0.0117	-0.0228						-0.00384
Funds		(0.0186)	(0.0188)						(0.0270)
D_Second			-0.0694						-0.116*
generation			(0.0632)						(0.0655)
D_Second			0.00205						0.0125
gener. x Funds			(0.0114)						(0.0119)
D_Southern				0.259***					0.0656
region				(0.0666)					(0.0822)
D_Southern				-0.0559***					-0.0171
region x Funds				(0.0109)					(0.0144)
D_Southern				1.152***					0.387
x D_New				(0.433)					(0.497)
D_Southern				-0.143**					-0.0586
x D_New x F				(0.0612)					(0.0689)
D_Belgium x F					0.0198	(0.0365)			
D_Bulgaria x F					0.134	(0.340)			
D_Czech R. x F					0.0790	(0.0575)			
D_Germany x F					-0.242	(0.303)			
D_Denmark x F					0.000252	(0.0238)			
D_Ireland x F					-0.0495	(0.0416)			
D_Greece x F					0.0137	(0.0373)			
D_Spain x F					-0.00612	(0.0260)			
D_France x F					-0.0486	(0.0401)			
D_Italy x F					-0.0250	(0.0252)			
D_Hungary x F					0.0479	(0.0707)			
D_Netherl. x F					-0.0634	(0.0568)			
D_Austria x F					-0.00360	(0.0879)			
D_Poland x F					-0.0249	(0.0872)			
D_Portugal x F					0.0319	(0.0321)			
D_Romania x F					-0.136	(0.594)			
D_Slovenia x F					1.393	(1.449)			
D_Slovakia x F					0.0890	(0.134)			
D_UK x F					-0.00892	(0.0239)			
D_Border							0.0158		-0.0200
region							(0.0510)		(0.0495)
D_Border							0.00356		0.00710
region x Funds							(0.00849)		(0.00835)
D_EU Border								0.00646	-0.00641
region								(0.0118)	(0.0104)
D_EU Border								0.00310	0.00168
region x Funds								(0.00312)	(0.00275)
Employment	0.00723	0.0108	0.00263	0.0306***	0.00294		0.0129	0.00847	0.0105
agriculture	(0.00954)	(0.00905)	(0.00888)	(0.00932)	(0.00850)		(0.00979)	(0.00970)	(0.00966)
Unemploy-	-0.0686***	-0.0407***	-0.0511***	-0.0357***	-0.0265**		-0.0678***	-0.0734***	-0.0394***
ment	(0.0103)	(0.0109)	(0.0105)	(0.0113)	(0.0108)		(0.0101)	(0.0102)	(0.0111)
Population	0.0174***	0.0121**	0.00726	0.0253***	-0.00257		0.0251***	0.0221***	0.0111*
density	(0.00653)	(0.00615)	(0.00594)	(0.00599)	(0.00581)		(0.00638)	(0.00640)	(0.00632)
Constant	-0.00504	-0.355	0.0950	-1.020***	0.114		0.206	0.0908	-0.363
	(0.352)	(0.341)	(0.356)	(0.368)	(0.350)		(0.348)	(0.358)	(0.375)
Lambda	0.387***	0.339***	0.284***	0.322***	0.0284		0.377***	0.398***	0.240***
	(0.0556)	(0.0555)	(0.0559)	(0.0568)	(0.0459)		(0.0557)	(0.0556)	(0.0561)
Sigma2	0.00523***	0.00465***	0.00420***	0.00455***	0.00140***		0.00515***	0.00537***	0.00375***
	(0.000480)	(0.000426)	(0.000383)	(0.000415)	(0.000127)		(0.000472)	(0.000494)	(0.000342)

Table A14: Spatial analysis with internet access matrix excluding interaction variables

	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)
VARIABLES	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF	GDPDIF		GDPDIF	GDPDIF	GDPDIF
GDP 2007	-0.112***	-0.0885***	-0.0403*	-0.0602**	-0.0505*	-0.0290		-0.112***	-0.110***	-0.0341
	(0.0235)	(0.0249)	(0.0244)	(0.0236)	(0.0282)	(0.0253)		(0.0230)	(0.0237)	(0.0271)
Investment	0.0362	0.0380	0.0353	0.0174	0.0607**	-0.0317		0.0220	0.0369	0.0306
	(0.0265)	(0.0262)	(0.0246)	(0.0237)	(0.0274)	(0.0206)		(0.0261)	(0.0265)	(0.0251)
Population	-0.363***	-0.357***	-0.350***	-0.279***	-0.331***	-0.0469		-0.329***	-0.368***	-0.277***
growth	(0.0522)	(0.0516)	(0.0485)	(0.0482)	(0.0527)	(0.0426)		(0.0518)	(0.0527)	(0.0499)
Human	0.185***	0.181***	0.152***	0.133***	0.119***	0.124***		0.177***	0.183***	0.103***
capital	(0.0335)	(0.0331)	(0.0315)	(0.0303)	(0.0378)	(0.0278)		(0.0328)	(0.0337)	(0.0337)
Funds	0.0191***	0.00298	-0.0105	-0.00219	0.0189***	0.00666		0.0152**	0.0193***	-0.0178*
	(0.00655)	(0.00905)	(0.00764)	(0.00746)	(0.00642)	(0.00632)		(0.00650)	(0.00656)	(0.00972)
D_Objective		0.0585**								0.0467**
1 region		(0.0230)								(0.0206)
D_New			0.124***	0.0863***						0.0846***
region			(0.0191)	(0.0196)						(0.0211)
D_Second				-0.0564***						-0.0474***
generation				(0.0108)						(0.0110)
D_Southern					-0.0678***					-0.0222
region					(0.0184)					(0.0173)
D_Southern					0.0799***					-0.00903
x D_New x F					(0.0284)					(0.0285)
D_Belgium						0.0603***	(0.0229)			
D_Bulgaria						0.132***	(0.0297)			
D_Czech R.						0.0215	(0.0266)			
D_Germany						0.0256	(0.0246)			
D_Denmark						0.0903***	(0.0205)			
D_Estonia						0.0414	(0.0438)			
D_Ireland						-0.107***	(0.0377)			
D_Greece						-0.146***	(0.0305)			
D_Spain						-0.0515**	(0.0257)			
D_France						0.00829	(0.0208)			
D_Italy						-0.00212	(0.0227)			
D_Latvia						0.112**	(0.0464)			
D_Lithuania						0.147***	(0.0468)			
D_Luxemb.						-0.0447	(0.0470)			
D_Hungary						0.108***	(0.0271)			
D_Matla						0.148***	(0.0475)			
D_Netherl.						-0.0133	(0.0237)			
D_Austria						0.0595**	(0.0271)			
D_Poland						0.226***	(0.0267)			
D_Portugal						0.0746**	(0.0310)			
D_Romania						0.296***	(0.0333)			
D_Slovenia						-0.0582	(0.0357)			
D_Slovakia						0.159***	(0.0286)			
D_Finland						-0.0580	(0.0443)			
D_UK						-0.0684***	(0.0188)			
D_Border	0.00995	0.00719	0.0116	0.00492	0.0165*	-5.44e-05		0.0118	0.00932	0.00644
Regions	(0.00963)	(0.00957)	(0.00895)	(0.00863)	(0.00953)	(0.00804)		(0.00942)	(0.00968)	(0.00875)
D_EU Border	-0.0736***	-0.0676***	-0.0398***	-0.0490***	-0.0507***	-0.0245**		-0.0680***	-0.0737***	-0.0379***
Regions	(0.0102)	(0.0103)	(0.0108)	(0.0104)	(0.0117)	(0.00997)		(0.0101)	(0.0102)	(0.0112)
Employment	0.0222***	0.0179***	0.0121**	0.00765	0.0229***	-0.00536		0.0247***	0.0223***	0.00876
agriculture	(0.00641)	(0.00654)	(0.00615)	(0.00592)	(0.00633)	(0.00529)		(0.00630)	(0.00641)	(0.00608)
Unemploy-								0.0367***		0.0192**
ment								(0.0102)		(0.00942)
Population									0.00725	-0.00123
density									(0.0118)	(0.0105)
Constant	0.164	0.0422	-0.384	0.00186	-0.403	0.266		0.224	0.128	-0.209
	(0.353)	(0.351)	(0.338)	(0.331)	(0.374)	(0.328)		(0.345)	(0.357)	(0.353)
Lambda	0.400***	0.394***	0.336***	0.278***	0.387***	0.0280		0.378***	0.399***	0.267***
	(0.0556)	(0.0554)	(0.0554)	(0.0557)	(0.0551)	(0.0449)		(0.0557)	(0.0557)	(0.0551)
Sigma2	0.00540***	0.00527***	0.00466***	0.00424***	0.00512***	0.00152***		0.00515***	0.00539***	0.00404***
	(0.000496)	(0.000484)	(0.000427)	(0.000386)	(0.000470)	(0.000138)		(0.000473)	(0.000496)	(0.000368)
Observations	243	243	243	243	243	243		243	243	
Standard errors in parentheses			*** p<0.01, ** p<0.05, * p<0.1							