ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ

Faculty of Human Geography and Planning

Barraí Hennebry MEconSc

Dynamics and Spatial Polarisation of Rural Regions in Europe. An Economic Investigation

Doctoral thesis written in the
Department of Economic Geography
under supervision of
Prof. Tadeusz Stryjakiewicz
Prof. Maria Ferreiro

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Dynamics and Spatial Polarisation of Rural Regions in Europe

An Economic Investigation

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1 Introduction

1.1 Research Goal and Justification of the Research

The goal of this research is to examine the dynamics and spatial polarisation of rural regions in Europe from an economic perspective. It is sometimes portrayed that rural regions are backward or stuck in a circle of decline (OECD, 2006), where there is a lack of job opportunities and people are forced to migrate out of the regions to find employment. However, there are some rural regions which are witnessing a growth in employment and in-migration. The polarisation of rural regions, for the purpose of this thesis, refers to the thriving of some rural regions while other rural regions are trapped in a downward spiral. The purpose of this research is: (1) to understand the extent to which this polarisation exists, (2) what factors are leading to polarisation and (3) how shocks (such as the financial crisis of 2008) contribute to this polarisation, in other words: how resilient rural regions are.

This research hopes to fill a gap that currently exists in the regional studies literature. Within regional studies, urban economics has become a separate branch of study. However, rural economics still tends to be under-researched. For example, in the textbook *Local and Regional Development* (Pike et al., 2006) the word "urban" is mentioned 82 times, while the word "rural" is only mentioned 8 times. This should give an indication as to the lack of focus paid to rural areas as opposed to urban areas within regional studies.

There is a lack of economic models focusing on rural development (Ward & Hite, 1998). While the subject of rural development is mainly researched by sociologists, geographers and spatial planners (Furmankiewicz et al., 2010; Petrick, 2013), the economics of rural development is left underexplored. Most economic models either see all regions as homogenous or they treat all rural regions as homogenous. There have been efforts recently to address this either by adapting existing theories of economic development for rural studies (Terluin, 2003) or by using economic methods and language to create new models for explaining rural development (Petrick, 2013). There is still insufficient empirical research into the factors that differentiate structurally strong rural regions from structurally weak rural regions. This thesis hopes to fill the gap by researching the socio-economic characteristics that lead to polarisation between rural regions, in essence trying to understand why some rural regions are lagging while others are thriving.

1.2 Research Questions

This thesis attempts to achieve the goal of understanding the dynamics of rural regions and the polarisation of rural regions by addressing three research questions, each with some sub-questions. Each question will be addressed in an individual chapter.

Question 1) What are the regional disparities among rural regions in Europe? What is the trend over time? Can convergence be observed? What are the determinants of economic growth in rural regions?

This question will be addressed in chapter three. The first task of this question is to examine the regional disparities among rural regions in Europe in terms of GDP per capita and employment rates. This is done first at an EU scale and provides an understanding of where the poorer rural regions are located geographically. There will then be an analysis of the trend of the changing rural disparities, i.e. how these disparities have changed over time. This will be done on an EU level and then for two of the RurAction countries: Germany and Greece. It is important that this research is conducted both at the international and national level to understand how national setting is important for the development of rural regions. Germany and Greece were selected for the purpose of this question as these are two very different countries, facing different issues of regionalisation and it is important to understand the different dynamics at play within both countries and their corresponding influence on regional disparities among rural regions.

The final task is to check for convergence among rural regions in Europe. First this will be done at an EU level and then this will be done at a national level for both Germany and Greece. Convergence will be checked for the period 2000 to 2017 and then convergence will be checked for in two sub-time periods of pre-crisis and post-crisis (referring to the 2008 financial crisis). This is similar to the method used by Smętkowski (2018). This will show if the financial crisis exacerbated rural disparities or if it helped to equalise the economic output among rural regions.

Question 2) What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions?

This question will be addressed in chapter four. The structural strength of rural regions is a complex issue and cannot easily be understood by simple, one-dimensional measures of economic strength (such as GDP per capita). Therefore, the first task in addressing this question

is to create a multidimensional index which measures the structural strength of rural regions (the SSRR index).

Having successfully been able to create a measure for structural strength, this chapter will first calculate the SSRR index at an EU level (for all countries with available data) and analyse how it has changed over time from 2000 to 2015. It will then look at the socio-economic characteristics that contribute to structural strength. After completing this at an EU level, the research will then be done at a national level for two other RurAction countries: Austria and Portugal. These countries were selected for the purpose of this chapter as I again wanted a sample of two very different countries. Both countries face issues of regionalisation and this chapter will provide a better understanding of the rural polarisation in both countries, the changing dynamics over time and the determinants of structural strength.

Question 3) What is the economic resilience of rural regions i.e. how have they responded to the crisis of 2008/09? What are the socio-economic characteristics that contribute to resilience? Will resilience to the 2008 financial crisis be a predictor of resilience to the Covid19 crisis?

There is no doubt that there has been a surge in research regarding the concept of regional economic resilience since the 2008 financial crisis (Fröhlich & Hassink 2018). There has also been an offshoot of this which looks specifically at urban and city resilience (Simmie 2017; Tan & et al 2017; Martin & Gardiner 2019). Despite the fact that there is some evidence that rural regions are less resilient than urban regions there is, as of yet, a lack of research into the determinants of regional economic resilience in rural regions. The goal of this question is to highlight how rural regions, on a European level, have responded to the crisis to see if some rural regions were more resilient to the crisis than others. The research will then examine the socio-economic characteristics that contribute to resilience.

Despite the abundance of research into regional economic resilience, a drawback of this research is that the majority of it relies solely on the case of the 2008 financial crisis. It is unclear if resilience to the 2008 financial crisis will be a predictor for resilience to future crises. The ongoing Covid19 crisis is now providing us with a second case, which is very different in many respects, in which to understand economic resilience. To understand the correlation between resilience to the 2008 financial crisis and the Covid19 crisis, this chapter will take the case study of Ireland and analyse at a county level if resilience to the 2008 financial crisis is a predictor of resilience to Covid19 crisis. Ireland provides a good case study for the study of

resilience as it was one of the countries most affected by the financial crisis of 2008 but witnessed a strong recovery.

1.3 Research Goals in the Context of the RurAction Project

Many countries face the problem of lagging rural regions, i.e. rural regions tend to be less developed and less productive than urban regions. That is not to say that all rural regions are homogenous or that all rural regions are declining. In fact, some rural regions in Europe are thriving and seeing an increasing population and standard of living. The main goal of this thesis is to analyse the socio-economic factors which create these differences. This research will examine the current situation of rural regions in Europe, how this situation has changed over time and how rural regions responded to the 2008 financial crisis (in other words, how resilient they are). By answering the research questions from the previous section we will be able to understand the dynamics of rural regions in Europe and the process of rural polarisation.

This research is a part of a larger project entitled "RurAction – Social entrepreneurship in structurally weak rural regions: Analysing troubleshooters in action" which has been funded by the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska Curie grant agreement number 721999. RurAction recognises the lack of knowledge and research at the intersection of rural development, social innovation and social entrepreneurship. The RurAction research and training network focuses on problems in structurally weak rural regions in Europe and on the impact of social entrepreneurship and social innovation can have in creating and providing solutions to the problems in structurally weak rural regions.

In total, there are 10 PhD students in the RurAction project focusing on the intersection of rural development, social innovation and social entrepreneurship research. The research of each individual PhD student is subsequently very specific. The focus of the present thesis is solely on the economics of rural regions in Europe. Other researchers will be providing research which is complimentary to this thesis, in particular my colleagues from "Work Package 1: challenges and dynamics of structurally weak rural regions". This work package consists of three doctoral researchers in order to analyse the specific economic, political and cultural framework conditions of structurally weak rural regions. This provides the context of structurally weak rural regions for further research by the remaining PhD students. My colleague, Georgios Chatzichristos, will be analysing the political framework with respect to

rural regions for his thesis and my colleague, Sune W. Stoustrup, will be providing the analysis of the cultural framework. As a part of this work package, the purpose of this thesis is to provide an economic investigation into the characteristics of structurally weak rural regions. That is to say, this thesis hopes to explain the factors which differentiate struggling rural regions in Europe from the thriving rural regions in Europe. The question is which socio-economic factors create these differences.

The RurAction project has had much input from stakeholders, both social entrepreneurs and policy makers. As part of the research project there have been policy roundtables with policymakers from local to EU level, a policy brief with policy recommendations has been produced and is soon to be published. As part of this research I have participated in secondments at social enterprises in rural regions in Portugal and Austria. A handbook for practitioners has also been published, this handbook was created with research from the PhD students and is aimed at social entrepreneurs. This input from social entrepreneurs and policymakers has helped to guide the writing of this thesis and as a result I hope that this thesis has found a balance with being practically orientated as well as making a significant scientific contribution. This practical orientation has meant that there are many references and resources used that come from organisations and agencies such as the European Commission, ESPON and the OECD. This practical orientation has also led to the inclusion of specific case studies of individual countries within the three empirical chapters so although this is a study on the dynamics of rural regions in the EU there is special attention paid to different countries within the different chapters.

1.4 Source Materials and Data, Research Methods and Spatial and Temporal Scope

The thesis uses secondary data from various sources, most notably: Eurostat, OECD regional database and national statistics offices. The research uses a variety of techniques including simple descriptive statistics (such as mean, standard deviation, coefficient of variation and others), β-convergence testing, creation of a composite index, creation of a sensitivity index and econometric regression analysis. The techniques used for each chapter depend on a number of factors, such as data availability and appropriateness for answering the research question. There are three empirical chapters (chapters 3, 4 and 5) and further information regarding the methodology used for each chapter will be provided within the individual chapters. For now, this is just a brief overview of the methodology.

The first empirical chapter (chapter 3) deals with research question one (What are the regional disparities among rural regions in Europe? Can convergence be observed? What are the determinants of economic growth in rural regions?). For this chapter the analysis will focus on GDP per capita (PPS) and employment rate of rural regions as these are the most common measures of economic strength and provide a strong basis for understanding rural disparities. In order to address the sub-question of economic disparities the methods used in this chapter will be descriptive statistics to give an understanding of the current situation. β-convergence testing (such as used by Baumol 1986; Barro and Sala-i-Martin 1992 and others) will be used to understand if convergence exists. Ordinary least squares (OLS) regressions will be used to understand the determinants of economic growth in rural regions.

Chapter 4 will address the second research question (What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions?). Understanding the one-dimensional nature of using measures such as GDP, chapter four will present the creation of a composite index that captures the complexity of rural development. This index, called the *Structural Strength of Rural Regions Index* (SSRR index), measures the multidimensional nature of structural strength. The technique for order preference by similarity to ideal solution (TOPSIS) was used to create this index. The SSRR index will be examined over time to understand the trend of rural development. After gaining a better understanding of the concept of "structurally weak rural regions" from the SSRR index, this chapter will examine the determinants of structurally strong as opposed to structurally weak rural regions. In order to do this the author will use econometric methods, in particular OLS regression analysis.

The final empirical chapter (chapter 5) will address the third research question: What is the economic resilience of rural regions i.e. how have they responded to the crisis of 2008/09? What are the socio-economic characteristics that contribute to resilience? Will resilience to the 2008 financial crisis be a predictor of resilience to the Covid19 crisis? Economic resilience has become an important topic of research since the financial crisis of 2008 and is likely to remain so for the coming years due to the Covid19 recession. However, despite the growing interest in economic resilience, rural regions are often ignored. This chapter hopes to fill the gap by addressing the economic resilience of rural regions. To do this the chapter will use the a sensitivity index, similar to the one developed by Martin (2012). It will then use OLS regression to understand the determinants of economic resilience in rural regions.

Throughout the analysis chapters a selection of independent variables will be used that represent certain socio-economic characteristics of rural regions. These variables can broadly be divided into four categories: business and economy, people and population, rurality and society and community. These variables will be explained in greater detail in chapter 3, section 3.2.

There are a number of different spatial scopes to this study. In the broadest sense this research is examining rural regions in Europe. By region, we are referring to NUTS3 regions, and by rural we are simply referring to the definition of rural by the European Commission (that is to say that these regions have more than 50% of their population living in rural grid cells). There will be extra attention paid to rural regions within the RurAction countries, specifically Austria, Germany, Greece, Ireland and Portugal. Focusing on these countries will provide more specific, in-depth analysis at a country level. These countries were chosen as they all face the issue of lagging rural regions and rural polarisation, but to different degrees and due to different circumstances. This will be explored further in the later chapters. It is sufficient now to briefly mention that rural polarisation in Austria and Germany can be seen as being caused by historical factors, in Austria's case there was the aftermath of the Habsburg monarchy and the Soviet occupation of the East and Germany's rural polarisation was caused by the East-West divide. Greece, Ireland and Portugal face rural polarisation as a result of a core-periphery style economy. The economies of Greece and Ireland are skewed towards the capital cities (Athens and Dublin respectively), while the Portuguese economy is dependent on the Lisbon-Porto axis. Therefore, in these three countries rural weakness can be viewed as distance from the urban. These specific case studies of countries will provide us with sufficient examples to understand the dynamics of rural regions in Europe with respect to our three research questions.

For the temporal scope this research will look at the years from 2000 to 2017. There are two reasons for this. Firstly, this is the time period with the greatest availability of data. Secondly, this time period provides enough years prior to and following the financial crisis of 2008 to understand the growth paths of rural regions before the recession, the resilience of rural regions and the structural change caused by the crisis.

1.5 Basic Notions, Terminology and Definitions

Even though the word 'rural' is one that most people know, it can be difficult to define. Often people will use it interchangeably with concepts such as non-urban or peripheral and consider a generic rural which is sparsely populated, dominated by agriculture and lacking in facilities. The idea of rurality and what constitutes rural within rural studies has been debated and is constantly changing, in fact most "scholars recognise that there is no ubiquitous rural" (Gallent and Gkartzios, 2019: 25). In the 1970s and into the 1980s there was a general positivist view of what constitutes rural. It was felt that rurality could be measured in a quantitative manner and used for comparisons. The emphasis was on how to measure rural, and this was often done through creating indexes (Cloke, 1977; Cloke and Edwards, 1987). Cloke's (1977) index attempted to measure rurality by creating an index which included variables such as population density, proportion of population employed in the primary sector, age structure, distance to urban and others. There was a shift away from this positivist approach towards the end of the 1980s and early 1990s. Scholars had started to feel that quantitative definitions of rurality are too shallow and fail to capture the complexity of rurality (Hoggart, 1988; Halfacree, 1993). This was a turn towards a theoretical conceptualisation of rurality. Cloke (2006) responded to this cultural turn away from empirical studies and towards more theoretical based studies of rurality. He agreed with the flaws of a completely positivist view but lamented the conceptual studies detachment from functionality. He proposed that rural studies should hybridise theoretical and empirical studies in a way that "disrupts the binary relations between the theoretical and the empirical" (Cloke, 2006: 26). This thesis, as a foundation for further analysis within the RurAction consortium, was proposed as a purely quantitative, economic analysis of rural regions. This raises the issue of approaching a conceptual subject matter, rural studies, from a positivist position.

"Rural" is subjective and tends to differ between countries, making cross country comparisons difficult. Often rural is seen as remoteness or distance from urban centres which negates the multidimensional aspect of rurality. The concept of rural is usually associated with peripheral. Although it can be criticised for being overly simplified, this thesis will use the classification by the European Commission when referring to rural regions. The European Commission classifies a region as rural if over 50% of the population is living in a rural grid cell. A grid cell is considered rural if the population density is below 300 per km² and/or has a population below 5,000 inhabitants. Although this is a simplistic definition it is being used in this thesis for two reasons. Firstly, it is the most useful definition when making cross country

comparisons. The second reason is that using this definition makes data collection easier. Throughout the thesis, other variables for rurality (such as population density and access to service) will be used as independent variables to give an understanding of the levels of rurality and how this affects economic growth, structural strength and resilience.

The terms “structurally weak” and “structurally strong” will be explored and defined further in chapter four. For now, it is sufficient to understand a “structurally weak” region as a region that is stuck in a “circle of decline” (OECD, 2006). That is to say the region is suffering from population loss, population ageing, low productivity and lack of job opportunities. “Structurally strong” regions are regions that are reversing this trend. They have an increasing population, increasing productivity and job opportunities for the residents.

2 Literature Review

The purpose of this chapter is to provide an overview of the important literature for answering the three research questions. The chapter is divided into three subsections. Each subsection is referring to the theoretical and empirical literature relevant for one of the research questions. The first section (section 2.1) examines five of the mainstream growth theories in regional economics and what they predict for rural regions i.e. should there be rural polarisation, for what reasons might we see rural polarisation and is there likely to be convergence among rural regions in the long-run. It is important to understand this literature for tackling the first research question: "What are the regional disparities among rural regions in Europe? What is the trend over time? Can convergence be observed? What are the determinants of economic growth in rural regions?"

The second section of this chapter (section 2.2) deals with neo-endogenous rural development. From the previous section we will see that the mainstream economic growth theories are not sufficient for explaining why we might see rural polarisation in the long-run or what the characteristics of a structurally strong rural region are. Neo-endogenous rural development, along with the OECD's "circle of declining rural regions" (OECD, 2006) provides us with the theoretical framework for tackling research question two: "What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions?"

The final subsection (section 2.3) looks at the theoretical and empirical studies done on regional economic resilience. This section gives a brief explanation of different definitions of resilience and how they have helped shape a regional economics definition for resilience. The section will then present the findings from several empirical studies done on regional economic resilience following the 2008 financial crisis. This will provide the background for tackling the final research question: What is the economic resilience of rural regions i.e. how have they responded to the crisis of 2008/09? What are the socio-economic characteristics that contribute to resilience? Will resilience to the 2008 financial crisis be a predictor of resilience to the Covid19 crisis?

2.1 Rural Regions in Regional Economic Growth Theories

Rural development is a subject that is mostly researched by sociologists, geographers and spatial planners (Furmankiewicz et al. 2010). It is less often addressed by economists (Petrick 2013). Although it is not studied explicitly be regional economists, a lot can be learned from the growth models they use to understand what is to be expected in terms of the development of rural regions. These expectations are generally seen in respect to urban regions, a brief overview can be seen from the table 2.1. These models see rural regions as homogenous and therefore tell us little about what differentiates structurally strong rural regions from structurally weak rural regions. The following section is divided into five sub-sections, each sub-section is dedicated to a different growth model. The five growth models are neo-classical growth model (Solow, 1956), endogenous growth model (Romer, 1986; 1990), new economic geography (Krugman, 1991), stages of economic growth and regional inequalities (Rostow, 1960; Williamson, 1965) and growth poles (Hansen, 1967; Boudeville, 1968).

These growth models provide the theoretical framework for addressing the first research question: "What are the regional disparities among rural regions in Europe? What is the trend over time? Can convergence be observed? What are the determinants of economic growth in rural regions?". This research question is being addressed from a purely economic perspective and it is therefor important to understand the traditional, mainstream economic growth models for addressing this question. Understanding the predictions of these models for rural regions will shine a light on the predictions for rural polarisation and the dynamics of rural regions. It will tell us if we should expect increasing rural disparities and divergence or decreasing rural disparities and convergence.

Table 2.1: Growth models and their expectations for rural regions

Model	**Main Idea**	**Expectation for Rural Regions**	**Seminal Literature**
Neo-classical growth	$Y = f(K, L)$[1] Capital will flow to poorer regions	Convergence between rich regions and poor rural regions	Solow (1956)
Endogenous growth	$Y = f(AK, L)$[2] Efficiency of K affected by endogenous factors such as technology, geography, institutions, etc.	Conditional convergence depending on endogenous factors such as technology, physical capital, human capital, geography, institutions, etc.	Romer (1986; 1990)
New economic geography	Emergence of core-periphery due to transportation costs	Divergence between rich, core regions and poor, peripheral regions	Krugman (1991)
Stages of economic growth and regional inequalities	During early stages of development, income becomes unequal but becomes more equal during later stages	Divergence, followed by convergence	Rostow (1960), Williamson (1965)
Growth poles	Growth appears in points and spreads (but not evenly)	Divergence, followed by some convergence	Hansen (1967), Boudeville (1968)

Source: Own work

2.1.1 Neo-classical Economics

The neo-classical view of an equilibrium state where all regions converge has its foundations in the beliefs of classical economists such as Adam Smith and David Ricardo. Smith's work can be summarised as to be "concerned to show how the free pursuit of private gain can act to raise the levels of living of the entire community" (Preston, 1996: 53).

In his seminal work on political economy *On the nature and causes of the wealth of nations* (1776), Smith argues that there should be no difference in the standard of living between the urban and the rural regions of a country. The rural sends its excess produce to the urban, which cannot sustain itself. He sees all wealth being generated in the rural areas. The urban only produces convenience goods. He sees the reciprocal nature of the relationship as

[1] Y = output, K = capital, L = labour
[2] A = total factor productivity

having an equalising affect: *"The gains of both are mutual and reciprocal, and the division of labour is in this, as in all other cases, advantageous to all the different persons employed in the various occupations into which it is subdivided." (p. 373)*. In fact, Smith observes that since all subsistence and wealth is generated in rural areas, and urban areas do not have the ability for self-sufficiency, focus should be drawn to increasing the productivity of rural areas: *"The cultivation and improvement of the country, therefore, which affords subsistence, must, necessarily, be prior to the increase of the town, which furnishes only the means of conveniency and luxury." (p. 374).*

This idea of equilibrium between rural and urban was carried forward by Ricardo (Kaldor, 1956). Although Ricardo's work didn't explicitly look at the difference between regions, we can understand his views by looking at his theory of distribution if we assume that agriculture is more prominent in rural regions and industry is more prominent in urban regions. His work on distribution focused on the returns for the different factors of production (land, labour and capital). In Ricardo's theory the return for labour (wages) is set at a constant and the return for land (rent) is valued at the difference between the productivity of "marginal" land and the productivity of average land. What is left is the profit (i.e. the return for capital). As explained by Kaldor (1956: 86) in "a state of equilibrium, the money rate of profit *per cent* earned on capital must be the same in industry and in agriculture, otherwise capital would move from one form of employment to the other". Capital will always seek the highest return, therefore in a state of disequilibrium where the return for capital is higher in industry there will be higher investment in agriculture until the return is even. If we acknowledge that agriculture tends to be located in rural regions and industry is located in urban regions, then Ricardo's theory of distribution would seem to suggest that if rural regions are poorer than urban regions then capital should flow to rural regions, where it will be able to gain higher profit. This happens because the rate of return on capital is greater in poorer regions.

This idea that capital will flow to poorer regions is also the conclusion of neo-classical growth theory. As Pike et al. (2006: 65) explains it: *"Under the strict economic rationality and market-based conceptualisations of the neo-classical model, the perfect mobility of factors of production of capital and labour move to regions offering the highest relative rates of return. Firms look for the most profitable locations and labour seeks the highest wages."* This also implies that regional disparities are caused by a disequilibrium and when in a state of equilibrium there should not be any regional disparities.

The most popular growth model from the neo-classical background was developed by Solow (Solow 1956). In the Solow model output is a function of two factors; capital and labour, i.e. Y=f(K, L). This can be rewritten as Y=aK+bL (Morris 1998). In this model labour is constant at any given time, the output is dependent on the capital/labour ratio. There is a diminishing marginal return on capital, that is to say the highest return on capital (profit) is achieved when the ratio of capital to labour is lowest. The implication is that capital will be invested in the poorest regions so that in the long-term we should witness convergence as poor regions catch up with richer regions. The other implication is that there should be a "steady-state" level of growth where capital is increasing at the same pace as labour. At this point the economy is in equilibrium. This equilibrium implies that there has been complete convergence i.e. all regions have the same output and all regions experience the same growth rate.

If the neo-classical growth model holds then we should see convergence as poorer economies grow faster than richer economies. The main way to test this is using the β-convergence testing (this will be explained further in chapter 3). An early attempt to test for convergence at a national level was Baumol (1986). Baumol used historical data from Maddison (1982) to test the convergence of sixteen countries from 1870 to 1979. He used the annual growth rate as the dependent variable and the 1870 GDP per work hour as the independent variable. His finding showed strong signs of convergence. DeLong (1988) expressed two weaknesses with Baumol's research. Firstly, there was sample selection bias as the 16 countries that were used in his research were industrialised by 1979, meaning they already had similar productivity levels by 1979 so that if they were relatively poorer in 1870 they would show stronger growth. But this may not be the case for all countries that were poor in 1870. The second issue highlighter by DeLong was measurement error. Historical data going back to 1870 is questionable and likely to be somewhat inaccurate. If Maddison underestimates a country's wealth in 1870, it will overestimate the growth rate since then and similarly if he overestimates the wealth of a country in 1870 then he underestimates the growth. This measurement error will result in a stronger sign of convergence than in reality.

Testing for convergence at a regional level provides more scope for research as data is more abundant and more easily comparable. An early study of convergence at a regional level was Easterlin (1958). He divides the United States of America into nine regions and examines the regional GDP per capita income as a percentage of the national level from 1880 to 1950. He finds that the arithmetic mean deviation of regional per capita income from national level (this method will be explained more in chapter 3) fell from 45.6 in 1880 to 16.9 in 1950. This

is a strong sign of convergence. A more recent example of testing for convergence among regions is provided by Barro and Sala-i-Martin (1991). In their study Barro and Sala-i-Martin test the β-convergence among US states and European regions. For their research on European regions they check for convergence among 73 regions in 7 countries from 1950 to 1985. They estimate that the convergence rate among European regions is approximately 2%. They conclude that this holds that the neo-classical prediction of convergence holds but only if the diminishing returns on capital is low.

2.1.2 Endogenous Growth Model

The main finding of the neo-classical model is that capital should flow from rich countries and regions to poor countries and regions (Lucas 1990). If this is the case we should witness convergence among regions however there is dissatisfaction as empirical research shows that convergence is slow or non-existent (Barro and Sala-i-Martin 1991; Martin and Sunley 1998; Armstrong and Taylor 2000). This dissatisfaction with the neo-classical model has led to the development of the endogenous growth model which is seen by some as an expansion of the neo-classical growth model (Pike et al. 2006; Romer 2012).

The most prominent endogenous growth model was developed by Paul Romer (1986; 1990). There are some important differences between Romer's endogenous model and the neoclassical model. Firstly, Romer treats technological change as an endogenous factor that effects the efficiency of capital whereas the neoclassical model treats technological change as an exogenous factor. Secondly, the Romer model doesn't assume that there are decreasing returns on investment. Instead the Romer model recognises that there can be increasing returns to capital if there is investment into technological progress. The endogenous growth model can be visualised in equation form as follows:

$$Y = f(AK, L)$$

Where Y is output, K is capital, L is labour and A represents technological progress of the economy. In this model the efficiency of capital is a direct result of the technological progress. An increase in technological progress, spurred by investment into research and development, can lead to increasing output. The A in this model can represents technological change which can influence the efficiency of capital but there has been research that shows the efficiency of capital can be influenced by other factors such as culture (Clark 1987), geography (Bloom and Sachs 1998) and institutions (Acemoglu et al. 2004; Rodriguez-Pose 2013).

The ultimate conclusion of the endogenous growth model is that economic growth is determined by endogenous factors and that countries and regions will converge if they have similar endogenous characteristics. We refer to the conclusion of the endogenous growth model as conditional convergence as there will be convergence on condition of some endogenous factors. An example of some empirical work into the determinants of economic growth is Barro (1997). Barro uses OLS regression analysis with the growth rate from 1960 to 1990 of over 80 countries as the dependent variable. The independent variables which he finds has a positive effect on economic growth include: education, life expectancy, rule of law, terms of trade and democracy index. The variables which he finds to have a negative effect on economic growth include: initial level of GDP, fertility rate, government consumption ratio, and the inflation rate.

2.1.3 New Economic Geography

The model for new economic geography made headways with the publication of Krugman (1991). The object of his work was to examine how the regions of a country may diverge into having two types of regions; 1) an industrial core, and 2) an agricultural periphery. Krugman posed the question for himself as to "why manufacturing in general might end up concentrated in one or a few regions of a country, with the remaining regions playing the "peripheral" role of agricultural suppliers to the manufacturing "core"" (Krugman 1991: 485).

This approach differed to mainstream economic models as it didn't treat regions as dimensionless points which means that it accounted for the effects of transportation costs. This model concludes that regional divergence is possible and will depend on transportation costs, economies of scale and the size of the manufacturing industry. This can be illustrated on the hypothetical situation of two regions, region A and region B. Region A has a larger demand for manufactured goods. It would make sense for a factory to invest in region A, where demand is highest, and transport the remaining goods to region B. Once this initial advantage is established, other potential factories will benefit from economies of scale if they invest in region A. This will cause divergence between the region A (the core region) and region B (the peripheral region). The extent of the divergence will be determined by transportation costs, economies of scale and the size of the manufacturing sector.

There has been some evidence to confirm this hypothesis. Breinlich (2006) uses a new economic geography model to analyse the regional variation and core-periphery structure of

the European economy. Analysing data for 193 NUTS 2 regions from the EU15 (member states prior to the 2004 enlargement) from 1975–1997, the study finds that market access accounts for 30–40% of income variations.

2.1.4 Stages of Economic Growth and Regional Inequalities

Rostow, an economic historian at MIT, wrote the book *Stages of Economic Growth* (1960) where he theorised that there were five distinct stages of national economic growth. These five stages are:

Stage 1: Traditional society. In a traditional there is a lack of technological advancements and industry. A high proportion of resources are allocated towards agricultural produce.

Stage 2: Preconditions for take-off. In the second stage the conditions for take-off are put in place. This means there is more input from a central political power, especially in terms of investment in infrastructure, and there is an increase in the manufacturing and banking sectors.

Stage 3: Take-off. During the third stage is when the economy sees steady rate of high growth rates. During this stage the political power emphasises the modernisation of the economy, there is a surge in technological advancements and reinvestment of profits which enables further growth.

Stage 4: Drive to maturity. During the fourth stage the economy becomes more complex, diversifies production and moves production away from the sectors which originally led to the take-off.

Stage 5: Age of mass consumption. During the final stage there is a shift in production towards durable consumer goods and services.

Williamson (1965) used this theory to explain regional inequalities and argued that each stage of growth would see different evolution of regional inequalities. Measured over the five stages, regional inequalities would be shaped similar to a bell-shaped curve (Alonso, 1980). During the first stage regional inequality would be low as all regions were poor. There would be slight increase in regional inequality during the second stage, but stage three was when there would be the largest increase in regional inequalities as growth was centred in a few core regions. Stages four and five would see a decrease in regional inequalities as economic growth would spread from the core regions to the peripheral regions. This concept is represented

graphically in figure 2.1. This is similar to the work of Kuznets (1955) who proposed that personal inequality would increase during initial stages of economic growth but would fall during later stages of growth.

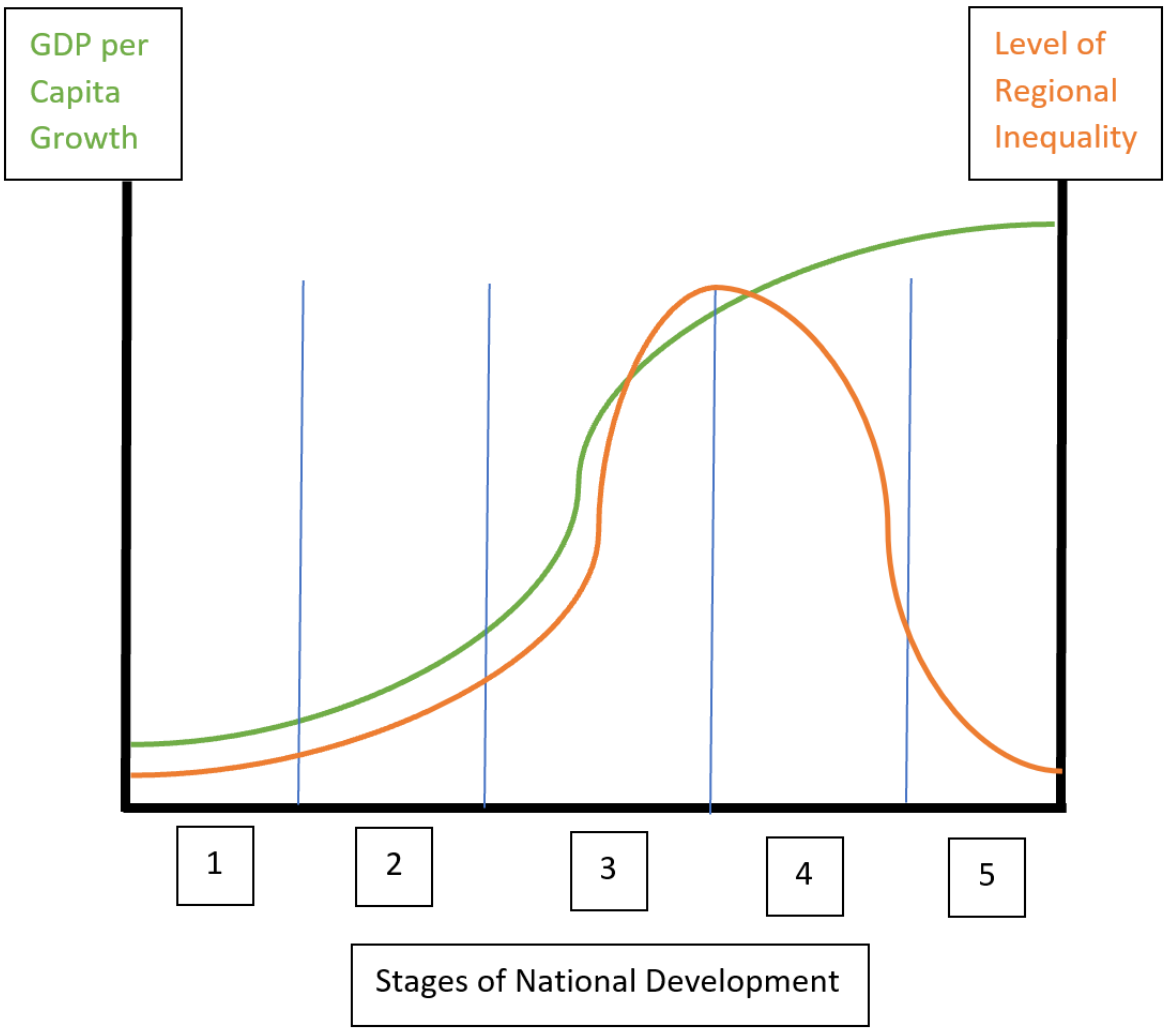

Figure 2.1: Stages of national development and levels of regional inequality

Source: Own interpretation of the work of Rostow (1960) and Williamson (1965)

Williamson's (1965) belief is that during the take-off stage of economic development growth will be located in some core regions for the following four reasons:

1) Natural resource endowments. Some regions have natural advantages that would enable them to take advantage of economic growth.

2) Labour migration. Labour from other regions will migrate to take advantage of this economic growth, especially more skilled or entrepreneurial labour.

3) Capital movements. More capital will be invested into these core regions in order to reap a higher return on investment.

4) Government policies. Policies will be enacted, perhaps inadvertently, which benefit the core regions.

This theory assumes that increasing regional inequalities would be temporary and that the benefit of economic development would spread from the core regions out to the peripheral regions in the later stages of economic development (Alonso, 1968). Amos (1988) expanded on this theory by examining what happened in the latter stages of development i.e. post the mass consumption stage and the convergent stage of the inverted-U. His empirical work found that countries in latter stages of development witnessed an increase in regional inequality, drawing the conclusion that "regional inequality appears to follow a pattern of increase-decrease-increase, contrary to the simple inverted-U pattern" (p. 565).

2.1.5 Growth Poles

Growth Poles theory was originated by the French school of regional economics mainly by Perroux (1955) and Boudeville (1968). The most influential early English paper explaining the theory of growth poles remains Hansen (1967), while Churski (2014) further explains how the growth poles theory is a polarisation-diffusion model. There are some similarities, but also some important differences, between the theory of growth poles and the theory of stages of development and regional inequalities. The theory of growth poles also expects growth to be concentrated in a single 'core' region. However, growth pole theory focuses more on industries being the catalyst for this growth rather than the competitive advantage of the region itself. Similarly to the stages of development theory, the growth would spread out from this original growth pole. However the spread of this growth would not be even. Instead it would be dependent on the inputs and outputs of the industry which was causing this growth. If the industry which was leading the growth relied on inputs (i.e. raw materials) from surrounding, rural regions then the growth would spread. What this theory means for economic polarization and rural development is that economic development is likely to cause divergence in the short term with the growth being concentrated in specific industries located within core, urban regions and growth in rural regions remaining stagnant. This will likely be followed by some

convergence, but this convergence will not be complete and will be conditional on the inputs that rural regions provide to the core regions. If a rural region produces inputs which are essential for this booming industry, then it is likely that the rural region will witness a subsequent boost in growth, but it is unlikely to catch up with the core region.

2.2 Neo-endogenous Rural Development

As can be seen from the above sections, the mainstream economic growth models tell us little about what differentiates structurally strong rural regions from structurally weak rural regions. The following section is dedicated to a relatively new growth model, neo-endogenous rural development, which attempts to explain how there can be rural polarisation, i.e. a divergence between thriving rural regions and rural regions which are trapped in a "circle of decline". It is divided into two sub-sections; the first section will explain the theoretical background and the second section will examine the formal model of neo-endogenous rural development. This growth model provides the theoretical framework for addressing research question 2: "What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions?"

2.2.1 The Theoretical Background of Neo-endogenous Rural Development

Neo-endogenous rural development grew out of a dissatisfaction for the rural development theory and policies which preceded it. Views towards rural development up to the 1970s can be described as an exogenous approach towards rural development (Cejudo and Navarro 2020). Rural development was seen as only possible by demand-led approaches which meant increasing demand from, and exports to, urban regions through the modernisation of agriculture and industrialisation. This was a top-down approach which was sectoral rather than territorial in nature. This was replaced by more endogenous views which concentrated on bottom-up approaches. The endogenous approach differed from exogenous in three main aspects: there was a shift from sectoral to territorial basis, there was a focus on the use of local resources and public participation was promoted (Ray 2000; Shucksmith 2000). This approach was criticised for its emphasis on the competitiveness of rural regions and led to the "welfare states incremental withdrawal of public services, increased responsibility for service provision

by voluntary workers, and the generation of partnerships of dubious democratic legitimacy that exist alongside local government" (Shortall 2004: 109).

The neo-endogenous rural development theory incorporates elements from both the exogenous and endogenous approaches. As with the endogenous approach, the neo-endogenous approach promotes a community led local approach to rural development but it understands the importance of external actors including national and European institutions. It promotes co-operative social relations between individuals and institutions for creating agency and promoting development (Shucksmith 2010). Ray (2006) identifies the two primary characteristics of neo-endogenous rural development as maximising economic benefit for the local region by maximising the use of local resources (physical and human) and a focus on the needs of the local people. Ray (2006) also emphasises the three planes on which neo-endogenous rural development operates: intra-territorial, vertical (politico-administrative) and inter-territorial. Intra-territorial refers to the social relations within the rural region and the co-operation between these actors. The vertical refers to the relationships between local actors and government institutions, both national and European. The inter-territorial refers to the relationships between local actors and actors from other regions, for example this could refer to the demand stimulated in other regions for local produce or tourists coming from other regions.

2.2.2 The Model for Neo-endogenous Rural Development

The theoretical background of neo-endogenous rural development has its roots in rural sociology as have been described in the previous section. The economics behind neo-endogenous rural development have seldom been explored. The model in this section (Petrick 2013) differs from the previous section as it uses economic language and methods to develop a robust economic model which explains neo-endogenous rural development and shows how rural polarisation can occur from an economic perspective. As far as I have found, this is the only attempt to create a formal model of neo-endogenous rural development which uses economic language and methods.

The formal model for neo-endogenous rural development is provided by the work of Petrick (2013) who uses evolutionary game theory to model rural development as the "increasing realisation over time of gains from interaction by rural stakeholders" (p. 707). The model that Petrick (2013) provides shows that there are two Nash equilibrium points for rural

regions, one equilibrium point is where the rural region is trapped in decline and the other equilibrium point is where the rural region is thriving. For this model the rural population is divided into two groups of stakeholders, mobile and immobile, and each group has two potential strategies.

The mobile group is characterised as being the younger, more educated population. This group has less restrictive ties to the rural regions (no dependent relatives, and they don't own property or have other investments in the region). Their education provides them with the possibility of finding employment in an urban region. This group lacks financial security meaning that they are unable to invest in the local economy. This population has two possible strategies; they can stay in the rural region or move to an urban region.

The immobile group is characterised as being the older and less educated population. This group has restrictive ties in the rural region (dependent relatives, or they own property in the rural region) or their skills likely prohibit their potential to seek employment in urban areas (farming, fishing, etc.). This means that their movement out of the rural region is restricted. Unlike the mobile group however they do have more financial security meaning that they can invest in the local economy. Their two strategies for this group are: they can invest in the local economy or they can abstain from investing.

Table 2.2: The rural coordination game

	Immobile invests locally	Immobile abstains from investing
Mobile stays in the rural region	**Y, Y**	Wr, Wr
Mobile moves to urban region	Wu, 0	**Wu, Wr**

Source: Petrick (2013: 714)

Table 2.2 shows the results of the neo-endogenous rural development model where; Y = the net payoff of staying/investing in a thriving rural region, Wr = the rural wage rate and Wu = the urban wage rate. It is assumed that Y > Wu > Wr > 0. There are two Nash equilibrium points, which are presented in bold. A Nash equilibrium point is an outcome to a game where

neither player can improve their outcome, assuming that the other player leaves their choice unchanged (Nash 1951).

Firstly, the two unstable outcomes of the game need to be addressed. In the top right corner, we have a situation where the mobile group stays, and the immobile group abstains from investing. This means that both groups earn the rural wage rate. This is unstable as either group could improve their outcome by changing their option. The mobile could move and earn the urban wage rate, which is higher than the rural wage rate or the immobile could invest and earn Y which is higher than the rural wage rate. In the bottom left corner, we have another unstable outcome where the mobile moves to the urban region and the immobile invests. In this outcome the mobile groups earns the urban wage rate and the immobile earns 0 (as there is not enough population remaining in the rural region for the immobile to make a profit from their investment). This is again unstable as either group could improve their outcome by changing their option. The mobile could stay and earn Y or the immobile could abstain from investing and earn the rural wage rate.

There are two equilibrium points in this game. The result in the bottom right corner is an equilibrium point where the rural region is trapped in a "circle of decline". In this outcome the mobile group has moved to the urban region and the immobile has abstained from investing. Neither party can improve their situation by changing their option, unless the other party also changes. In this outcome we have what could be seen as a structurally weak rural region, which experiences outmigration, an aging population and lack of investment.

The other equilibrium outcome is the top left corner. In this outcome the mobile group stays and the immobile invests, which leads to both parties earning Y (the net payoff for staying/investing in a thriving rural region). The investment from the immobile group provides opportunities to the mobile group which incentivises them to stay and the larger population creates the market for the immobile to earn a profit on their investment. In this outcome we have a thriving rural region which can be described as a structurally strong rural region. This region will experience a growing population and increasing investment.

2.3 Regional Economic Resilience

The third research question for this thesis looks at the regional economic resilience of rural regions in Europe following the recession caused by the financial crisis of 2008. This is

an important area of research to understand the dynamics of rural regions the structural change that happens in response to a shock. It is also an important question as, although regional resilience is a much-studied area, the topic of resilience within rural regions remains under-researched. This section is divided into two sub-sections. The first section will examine the different definitions of resilience in terms of economics and the second sub-section will give an overview of some empirical studies into regional economic resilience.

2.3.1 Definitions of Regional Economic Resilience

It shouldn't be surprising that the topic of regional economic resilience has been gaining in popularity in recent years, as Hassink (2010: 45) stated "the most intriguing questions in economic geography is why some regional economies manage to renew themselves, whereas others remain locked in decline". With the recent surge in interest, there have been a number of papers published regarding the concept of resilience from a regional economics point of view (Simmie & Martin 2010; Martin 2012; Lang 2012; Tóth 2015). However, there has been a difficulty in defining resilience. In general, the definitions of resilience in regional economics are based on the work from other fields of study (Martin & Sunley 2015), and all lend themselves to different schools of thought in economics. Table 2.3 provides an overview of these definitions which can be divided into three different categories. The first category of definitions sees resilience of the economy as the "speed of return to equilibrium" (Holling 1996, p. 33). This definition comes from engineering and fits well with the neo-classical school of economic thought. It assumes that the economy has one equilibrium point. A shock, such as a recession, will be temporary and will not have a permanent effect on the economy (Cellini and Cuccia 2019). Under the second category, resilience is seen as the ability to absorb shocks before altering its structure (Holling 1973). This understanding is derived from ecological science and fits well with a Keynesian view of the economy. It doesn't assume a single equilibrium point but instead assumes a number of equilibrium points (Davoudi 2012). Therefore a shock can push the economy into a lower equilibrium point. The final category of definitions comes from psychological sciences and organisational theory and sees resilience as "the ability to adapt in anticipation of, or response to, shocks" (Hennebry 2018, p. 100). This can be referred to as "evolutionary resilience" (Davoudi 2012), which lends itself to evolutionary economics in the sense that there are no set equilibrium points, but instead equilibrium points change and evolve over time depending on the circumstances. The economy

is seen as being "complex, non-linear, and self-organising, permeated by uncertainty and discontinuities" (Berkes & Folke 1998, p. 12).

Table 2.3: Definitions of Economic Resilience

Field of Study	**Definition**	**Equilibrium Points**	**School of Thought**
Engineering	Speed of return to equilibrium point	Only one equilibrium point	Neo-classical
Ecological science	Ability to absorb shocks before altering its structure	Several equilibrium points	Keynesian
Psychological sciences and organisational theory	Ability to adapt in anticipation of, or response to, shocks	Equilibrium points change over time	Evolutionary economics

Source: Own work

These various categories of definitions of resilience have led scholars to the development of a single, comprehensive definition of resilience within the study of regional economics. This thesis will use the following definition, as proposed by Martin and Sunley (2015: 13) who define resilience as:

"the capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources".

2.3.2 Empirical Research on Regional Economic Resilience

There have been a number of empirical studies done recently on the factors contributing to economic regional resilience from the economic crisis of 2008/09. These studies use a wide variety of methods, from case studies to sophisticated econometric models, and have provided some interesting results. Hennebry (2018), focusing on Ireland, and Dokic et al. (2016),

focusing on Croatia, both find that the recession led to increasing regional disparities in their respective countries. Hennebry (2018) provides a case study of Ireland using descriptive statistics to show that urban regions in Ireland were more resilient. Dokic et al. (2016) used econometric models to show that construction and trade were the most important determinants of resilience. Lapuh (2018), looking at municipalities in Slovenia, also found that the most developed regions were the most resilient. Other factors that helped resilience included regions being export orientated, densely populated and having a well-educated work force. Cellini and Cuccia (2019) found in regions of Italy that cultural behaviours contributed to regional resilience.

There is no doubt that there has been a surge in research regarding the concept of regional economic resilience since the recent economic crisis (Fröhlich & Hassink 2018). There has also been an offshoot of this which looks specifically at urban and city resilience (Simmie 2017; Tan & et al 2017; Martin & Gardiner 2019). Despite the fact that there is some evidence that rural regions are less resilient than urban regions (Hennebry 2018) there is, as of yet, a lack of research into the determinants of regional economic resilience in rural regions. One study that does look at the determinants of resilience in rural regions is Sánchez-Zamora et al. (2014). Sánchez-Zamora et al. (2014) use data envelopment analysis (DEA) to identify successful territorial dynamics for rural areas in Andalusia region of Spain. The authors specifically look at successful territorial dynamics as determinants of resilience in regard to the early stage of resilience which they describe as "the preparation of territory for changes that could give rise to a situation of shock" (p. 22).

Sánchez-Zamora et al. (2014) find a number of interesting determinants of resilience. Although they find that economic diversification helps to build resilience, they also find that agriculture is important in rural areas as they see it as a "haven sector" from the recent crisis. For infrastructure they found conflicting results. An increase in built-up areas, if resulting in an increase in urban fabric, had a negative effect. However, when the increase in built-up areas led to improvements in access to public services and overall connectivity of rural areas then it had a positive impact on resilience. Another factor that they find that may favour the resilience of rural areas is institutional capacity and governance as they see as proper management of rural development funding "facilitates cooperation between people and public institutions, thus building positive synergies, promoting proper functioning of the system of governance, and contributing to the development of rural areas" (p. 23).

3 Regional Disparities Among European Rural Regions

3.1 Introduction

The purpose of this chapter is to address the first research question: "What are the regional disparities among rural regions in Europe? What is the trend over time? Can convergence be observed? What are the determinants of economic growth in rural regions?" In much of economic theory rural regions are seen as homogenous and are considered to be facing the same challenges. An in-depth analysis of economic growth theories and their expectation for rural regions is provided in section 2.1 of the literature review. It is important here only to summarise what has already been explained in that section. The five mainstream economic growth models provide alternative implications regarding regional disparities, convergence and the determinants of economic growth for rural regions. This chapter will explore the data to analyse which, if any, of these theories provide the best foundation for understanding the situation in rural regions.

The neoclassical growth model predicts that over time all regions (whether they are urban, intermediate, or rural) will converge to a common level and a steady-state growth path (Solow, 1956). The endogenous growth model recognises that not all regions are equal and that there are some intrinsic characteristics that may cause some regions to grow at a higher rate (Romer, 1987). This therefore means that regions will experience conditional convergence, i.e. they will converge on condition that they have similar endogenous characteristics (such as technological progress, human capital, physical capital, etc.) that promote growth. New economic geography expects that economies will diverge with a fast-growing core and a slow, backward periphery (Krugman, 1991). This means we are likely to see divergence in that rural regions located near urban core regions will grow faster than more remote, rural regions as the rural regions near core regions will benefit from proximity to the core. The stages of economic growth and regional inequalities theory (Williamson, 1965) sees convergence to be like an inverted-U shaped curve. At the early stages of development economic growth is centred in large urban regions and therefore the economy sees divergence. As an economy continues to grow there are spill-over effects and the benefits of economic growth spreads out from the urban regions into the surrounding rural regions. Therefore, we are likely to see convergence in the latter stages of development. Growth poles (Hansen, 1967) predict a similar results to the stages of economic growth and regional inequalities theory in that it expects growth to be centred in some industries which causes a growth pole in the regions that have an advantage in

these industries. As growth continues there are likely to be spill over effects for the surrounding regions, but this is dependent on the input-output relationship these regions have with the growth pole. Therefore, there is likely to be divergence followed by some convergence, but this convergence is likely to be sporadic and not balanced across all regions.

Section 2.1 of the literature review also presented the findings of empirical studies that proposed to testing these various theories. There has been evidence shown to argue in favour of all these theories. From the point of view of this thesis, the main drawback from the empirical work has been its focus on all regions (urban, intermediate and rural). The focus of this thesis is primarily rural regions and it is therefore important to analyse the data exclusively for rural regions. As can be seen the idea of convergence is of central importance in all the mainstream economic theories. Therefore this chapter is dedicated to understanding the reality of regional disparities among rural regions, the changing dynamics of regional disparities, the convergence of rural regions since 2000 and what factors have contributed to economic growth of rural regions since the financial crisis of 2008. The rest of the chapter is divided in six further subsections. Section 3.2 explains some of the methodology used throughout the chapter. Section 3.3 gives an overview of rural regional disparities in Europe and how they have been changing over time. Section 3.4 focuses on the experience of two countries with respect to changing rural disparities: Germany and Greece. Both these countries have faced rural disparities of different causes: Germany has faced an East-West divide in rural disparities due to the partition of the country and Greece has faced a core-periphery divide due to the central role of Athens in the economy. Section 3.5 examines for absolute convergence of rural regions, a central idea in neoclassical economics, using β-convergence testing. This β-convergence is tested for all rural regions in the EU and then done for both Germany and Greece. This testing is conducted from 2000 to 2017 and then repeated for the pre-crisis time (2000-2008) and the post-crisis time (2008-2017). Section 3.6 uses OLS models to analyse what are some of the main factors contributing to economic growth in rural regions between 2008 and 2017. This is done by using a variety of independent variables which will be discussed below. Section 3.7 will provide a summary of what has been learnt from this chapter.

3.2 Methodology

In an attempt to understand regional disparities among rural regions in Europe this chapter adopts several different techniques. Section 3.3 uses descriptive statistics and thematic mapping to analyse the current disparities that exist among rural regions in the EU. The variables under analysis in this section are GDP per capita (PPS) and employment rate as these are often seen as the most important indicators of an economy's strength. This section will examine three measures of regional disparities of rural regions across the EU, all with respect to GDP per capita (PPS):

1. Coefficient of variation which is calculated using the following formula: $(\sigma/\mu) *100$ and gives a measure of the growing or diminishing regional differences[3].
2. Mean deviation from the EU27 level of GDP per capita. This measures the average difference for rural regions compared to the EU27 level and will give an indication as to whether there is a growing disparity between core-periphery.
3. Mean deviation from the average for EU rural regions. This measures the average difference for rural regions compared to the average of all rural regions. This will show if there is an increasing or decreasing disparity between rural regions.

Section 3.4 will repeat these measures but on a national level for Germany and Greece.

As convergence is an important idea in economic theories section 3.5 will use β-convergence testing to understand if there is convergence among rural regions in the EU. β-convergence testing is a common tool used for analysing convergence over long-term (Baumol, 1986; Barro and Sala-i-Martin, 1992; 2004) but has also been used to analyse shorter term trends such as the effects of EU cohesion policy on the development of Central and Eastern European regions (Dyba, et al. 2018). Barro (1997) represents the model in the following equation form:

$$Dy = f(y, y^*), \quad (1.1)$$

Where; Dy is the growth rate of GDP per capita, y is the starting level of GDP per capita, and y* is the steady-state or long-run level of GDP per capita. This means that at a given level of y* "a higher starting level of per capita output, y, implies a lower per capita growth rate" (Barro, 1997, p. 9). In this model our dependent variable is average annual growth rate of GDP per capita (PPS) and the independent variable is the log of the initial level of GDP per capita (PPS).

[3] σ = standard deviation; μ = mean

The logarithmic form is used as this ensures the results are easily interpretable, this is in line with the standard practice for β-convergence testing (Barro, 1997). If the coefficient is negative it means that we are witnessing a convergence effect. This β-convergence testing is conducted over three time periods: the full time period (2000-2017), the pre-crisis time period (2000-2008) and the post-crisis time period (2008-2017). This is done first for all rural regions in the EU, then for both Germany and Greece.

Section 3.6 builds on the β-convergence testing in section 3.4 by building OLS models to understand what are the other possible determinants which drive economic growth in rural regions of Europe. The dependent variable is the average annual growth rate in the post-crisis time period. For the independent variables I use a selection of socio-economic variables. These variables are described below but it is important to note that these same variables will be used again as independent variables in chapters four and five.

The independent variables will come from the framework provided by ESPON ECR2 (2014). This is a comprehensive study on the economic resilience of NUTS 2 regions which uses a mix of case studies and quantitative methods. They find that the factors contributing to resilience can be divided into four broad categories: business and economy, people and population, place-based, and society and community. For the purpose of this thesis 'place-based' variables will be referred to as 'rurality' indicators as we are interested in understanding the effect of rurality on economic growth, structural strength and economic resilience. This study will use the framework of ESPON ECR2 (2014), and specifically these four categories. The independent variables chosen can be divided into these four categories.

For "business and economy," I am interested in the following: the strength of the regions' economies prior to the recession, for which we use GDP per capita (PPS); the innovativeness of the regions, where we use average annual EUTM[4] applications as a proxy; and the reliance on certain sectors (tourism, agriculture, industry, construction, retail, finance, and public administration). Further information regarding the definitions of these sectors is provided in table 7.1 in the appendix. For these variables I would expect a negative relationship between initial GDP per capita and economic growth. I also expect innovative regions to experience stronger growth.

[4] European Union Trade Mark

For “people and population,” I am interested in the human capital of the population. I use median age as an indication as to whether it is an older population, while education is used as a measure of human capital. From these measures we expect a young, well-educated population to be more beneficial for growth.

For “rurality” we are interested in the extent of rurality and access to services in the regions. Access to hospitals is more difficult in more remote locations (Ocana-Riola and Sánchez-Cantalejo, 2005) and access to healthcare (Mao et al., 2015) or distance to a hospital (Mountrakis, 2005) is often used in rurality indexes. Therefore I use both population density as a measure of rurality and the number of hospital beds as a measure of access to healthcare and as a proxy for accessibility more generally. Here I expect more remote and isolated regions to be at a disadvantage.

Finally, for “community and society,” we are interested in the social capital of the regions. I have one measure for social capital, which I see broadly as trust in the community. There has been theoretical and empirical work done on the links between crime and social capital (Rosenfeld, Messner and Baumer 2001; Buonanna, Montolio and Vanin 2009). The assumption being that a high rate of crime would be connected with low trust in the area, therefore there is a negative relationship between crime and social capital. One major weakness with this variable is that it is susceptible to measurement error, as crime rates depend on the crimes being reported. The opposite effect to what is assumed here could be argued, i.e. it could be argued that low social capital will result in less crimes being reported as the community may not be willing to report crimes if they don’t trust the police. For this reason I use motor vehicle theft rates as a proxy for local trust, as it is the most likely crime to be reported, even in areas with low social capital. For this variable, we expect lower crime to be beneficial for rural regions in terms of economic growth, structural strength and building resilience.

The variables we have used to measure these four categories are shown in Table 3.1. In general, data from early in the timeframe has been used to give an indication of the characteristics heading into the time period under investigation. However, in some cases it was not possible to gather this data (median age) and so more recent data was used. In two cases (tourism and education), the data was not available at a NUTS 3 level and therefore the NUTS 2 data were used as a proxy. Throughout the thesis location variables will also be used in some regression analysis. Location variables are similar to dummy variable so for example a location variable for Germany would mean that rural regions located in Germany received a value of 1,

while all other rural regions received a value of 0. This can show if there was any inherent advantage due to national setting.

Table 3.1: Independent Variables

Broad Category	**Variable Code**	**Variable Information**	**Source**
Business & Economy	GDP per Capita	Log of GDP per Capita (PPP)	Eurostat
	Patents	Annual EUTM applications per 10 million population	Eurostat
	Tourism	Number of bed places in short-term accommodation per population (NUTS 2)	Eurostat
	Agriculture	Percentage of workforce employed in agriculture	Eurostat
	Industry	Percentage of workforce employed in industry	Eurostat
	Construction	Percentage of workforce employed in construction	Eurostat
	Retail	Percentage of workforce employed in retail	Eurostat
	Finance	Percentage of workforce employed in finance	Eurostat
	Public Admin	Percentage of workforce employed in public administration	Eurostat
People/Population	Education	Percentage of population aged 25 to 64 with Tertiary Education	Eurostat
	Median Age	Log of median age of population	Eurostat
Rurality	Population Density	Log of inhabitants per km²	Eurostat
	Access to Healthcare	Number of hospital beds per 10 million population (NUTS 2)	Eurostat
Community/Society	Crime	Theft of motorized land vehicle (per 1,000 population),	Eurostat

Source: Own work

3.3 Rural Regional Disparities across the European Union

Economic disparities among regions are usually measured using two indicators: GDP per capita (PPS) and employment rate. Although these indicators have their weaknesses, and I will use a more multi-dimensional index in the next chapter, it is worth spending some time analysing the disparities of these traditional indicators among rural regions across the European Union. Figures 3.1 and 3.2 show the spatial distribution of GDP per capita (PPS) and employment rate for rural regions in the European Union respectively. In both instances the rural regions have been divided into four classes based on the following criteria:

- Class 1 – strong rural region when $X_i \geq \mu + \sigma$
- Class 2 – relatively strong rural region when $\mu \leq X_i < \mu + \sigma$;
- Class 3 – relatively weak rural region when $\mu - \sigma \leq X_i < \mu$;
- Class 4 – weak rural region when $X_i < \mu - \sigma$;

Where

X_i= value of GDP per capita (PPS) or employment rate for the i^{th} region,

μ = arithmetic mean of GDP per capita (PPS) or employment rate,

σ = standard deviation of GDP per capita (PPS) or employment rate.

These maps reveal some interesting facts about GDP per capita (PPS) and employment rate. Firstly to examine figure 3.1 which represents GDP per capita (PPS) in 2015 for rural regions in the EU. The weak class of rural regions, those with a low GDP per capita, are generally located along the Eastern part of the EU, these are the new member states and Greece. The strong rural regions, those with a high level of GDP per capita, are mainly clustered in the centre of the map around Germany, Austria, and some in the surrounding countries. Portugal, Spain, France and Italy have mostly relatively weak rural regions with some relatively strong. The rural regions in Ireland are, for the most part, relatively strong.

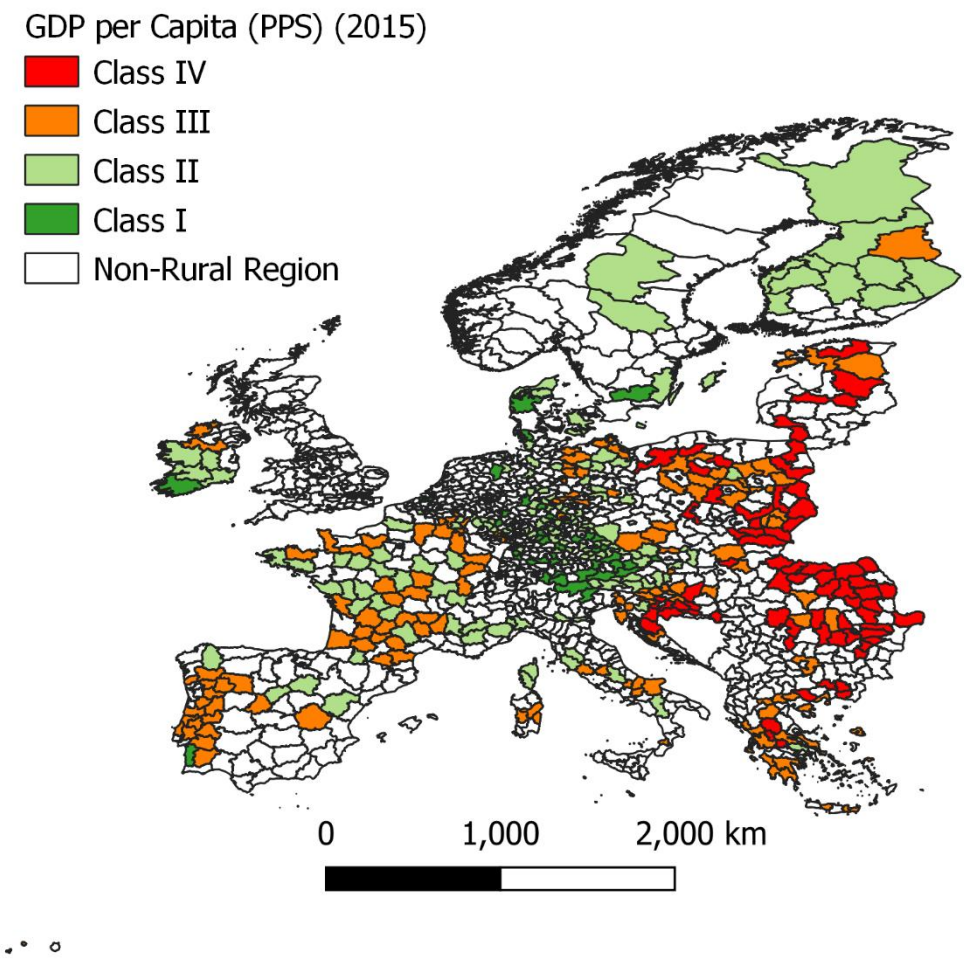

Figure 3.1: GDP per Capita of Rural Regions in the EU

Source: Own work using data from Eurostat

Figure 3.2 presents the employment rate in 2015 for rural regions in the EU. There doesn't seem to be as many weak regions. Along the Eastern side of the EU rural regions tend to be relatively weak but some are relatively strong and some even strong. The strong rural regions in terms of employment are clustered around Germany and Austria. Rural regions in Portugal, Spain, France and Italy are mostly relatively weak or relatively strong. The rural regions in Ireland are all relatively weak.

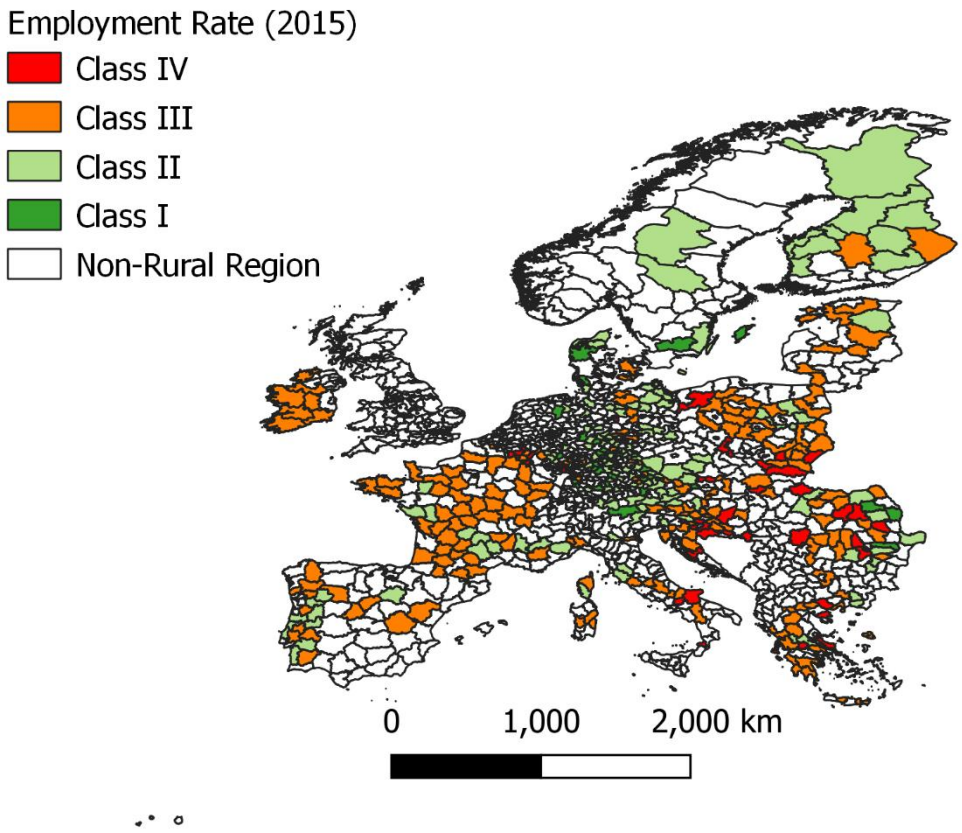

Figure 3.2: Employment rate of Rural Regions in the EU

Source: Own work using data from Eurostat

There is a strong positive correlation between the GDP per Capita and employment rate, the Pearson correlation coefficient is 0.73 and is significant at the 99% confidence level. However, we can also see some clear differences from the maps. In both instances, strong and moderately strong regions are clustered around Germany and Austria. Rural regions in Greece are disproportionately weak for both indicators. The rural regions in Eastern European countries are weaker in terms of GDP per capita (PPS) but this doesn't necessarily translate to being weak in terms of employment rate. In fact, a number of rural regions in Eastern Europe are strong and relatively strong in terms of employment. Rural regions in Ireland are relatively strong in terms of GDP per capita (PPS) but relatively weak in term of employment rate. This is also true for France and Belgium.

Table 3.2 provides a breakdown of the number and percentage of regions within each class for both GDP per Capita (PPS) and employment rate. For both indicators there are more than 50% of regions classified as weak and relatively weak, this means the distribution of regions is negatively skewed with the majority of regions ranked below the mean. For GDP per capita there are more regions classified as strong and weak (30% in total) compared to employment rate (20%), which indicates that GDP per capita is more skewed than employment rate.

Table 3.2: Breakdown of Number and Percentage of Rural Regions in Each Class

Class	**GDP per capita (PPS)**	**Employment rate**
I – Strong	51 *12%*	40 *10%*
II – Moderately Strong	142 *34%*	138 *33%*
III – Moderately Weak	146 *35%*	191 *46%*
IV – Weak	73 *18%*	43 *10%*
Total	412 *100%*	412 *100%*

Source: Own calculations using data from Eurostat

Figure 3.3 presents the trend of regional disparities using three different measures, all calculated using the GDP per capita (PPS): mean deviation from the EU level, mean deviation from the average of EU rural regions and the coefficient of variation. The mean deviation from the EU 27 level measures the difference between rural regions and the EU average. This figure was steadily falling from 2000 to 2009. It increased from 2009 to 2011 and has remained considerably consistent since 2011. This indicates that the disparities between rural regions in the EU and the overall EU average was falling until around the time of the financial crisis. The mean deviation from the average of EU rural regions is a measure of disparities between rural regions i.e. it shows if some rural regions are thriving and others falling behind. This figure

was falling from 2000 to 2009 which indicates that there was an equalising effect occurring among rural regions. However, this trend reversed from 2009 to 2011, possibly due to the financial crisis, and has remained consistent since 2011. The coefficient of variation measures if there are growing or diminishing regional disparities over time. This was on a downward trend from 2000 to 2009, increased from 2009 to 2011 and has remained constant since then. All three measures show the same general trend, downward sloping until 2009, an increase until 2011 and then stabilisation. This is an indication that there was diminishing regional disparities among rural regions and between rural regions and other regions before the financial crisis of 2008 but since then this trend has stopped.

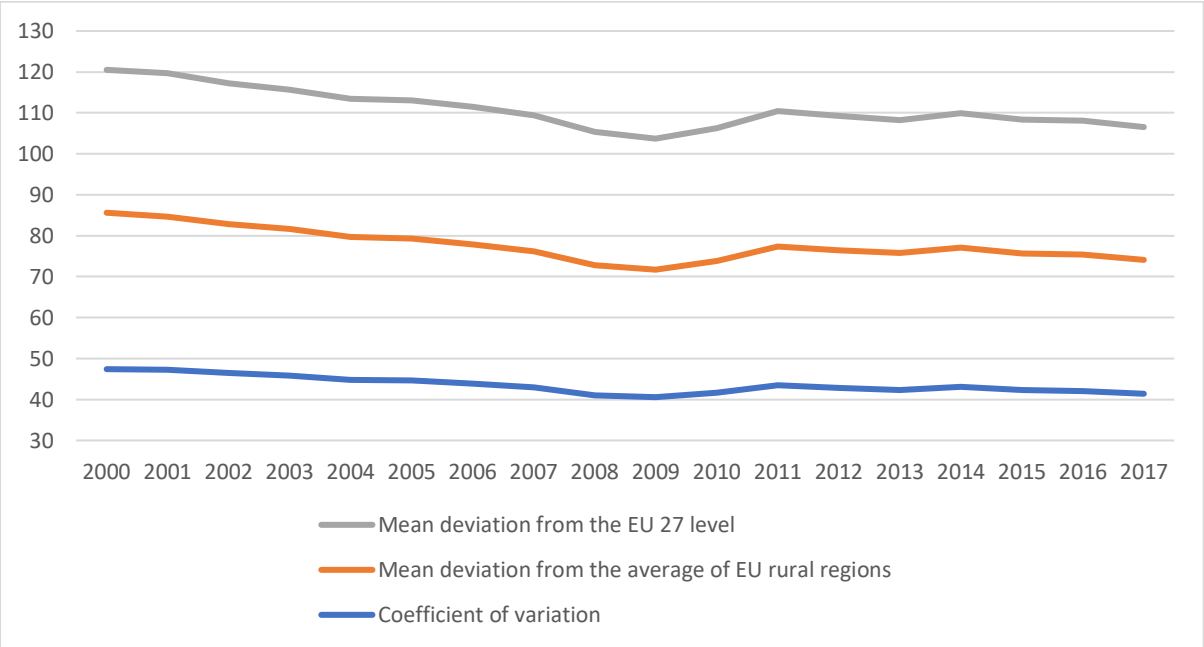

Figure 3.3: Measurements of regional disparities in GDP per capita for rural regions in the EU, 2000-2017

Source: Own calculations based on data from Eurostat

3.4 Rural Regional Disparities in Germany and Greece

The analysis in the previous section deals with rural disparities at an EU level. It is important to examine these trends also at a national level, to understand if the EU wide trend is being replicated at a national level. In order to do this a sample of two countries were chosen, namely Germany and Greece. These countries were chosen as part of the RurAction project. It was important to choose countries with significant differences in terms of culture, geography

and institutions. Although both countries are in the EU, they are geographically located in very different parts of Europe. Germany is a Northern European country and is located in the heart of Europe. Greece is a Southern European country located on the periphery of Europe. Both countries face regional disparities but of very different character. Germany faces regionalisation on an East-West divide while regionalisation in Greece takes a core-periphery dimension.

Since reunification in 1990 there has been the ongoing issue of regional disparities between the wealthier Western regions of Germany and the former communist Eastern regions. After reunification firms in East Germany were inefficient and due to high wages couldn't compete with the more efficient firms in West Germany which led to a recession in the East (Akerlof et al. 1991). Studies show that in the late '90s there was little sign of convergence (DIW et al., 2002) and using cluster analysis Kronthaler (2005) showed the 'most of the East German regions are not yet comparable with West German regions in economic capability' (p. 749). A more recent study by Margarian and Hundt (2019) looked at data from 2007 to 2016 and found that German regions could be divided into three categories: urban, rural west and rural east. They found that although urban regions in the East have become comparable to their Western counterparts there was still regional disparities between rural regions in the East and the West.

Figure 3.4 shows the three measures of regional disparities for German rural regions. The coefficient of variation appeared relatively consistent until 2007, since then it has been more volatile but has been experiencing a general downward trend which indicates diminishing regional disparities among rural regions. The mean deviation from the national level was consistent until 2007 but has since been experiencing a downward trend, which is a sign that rural regions are catching up with the rest of the country. The men deviation from the average of rural regions has seen the least amount of change. This has remained mostly consistent which indicates that there has not been any increasing or decreasing in disparities among rural regions.

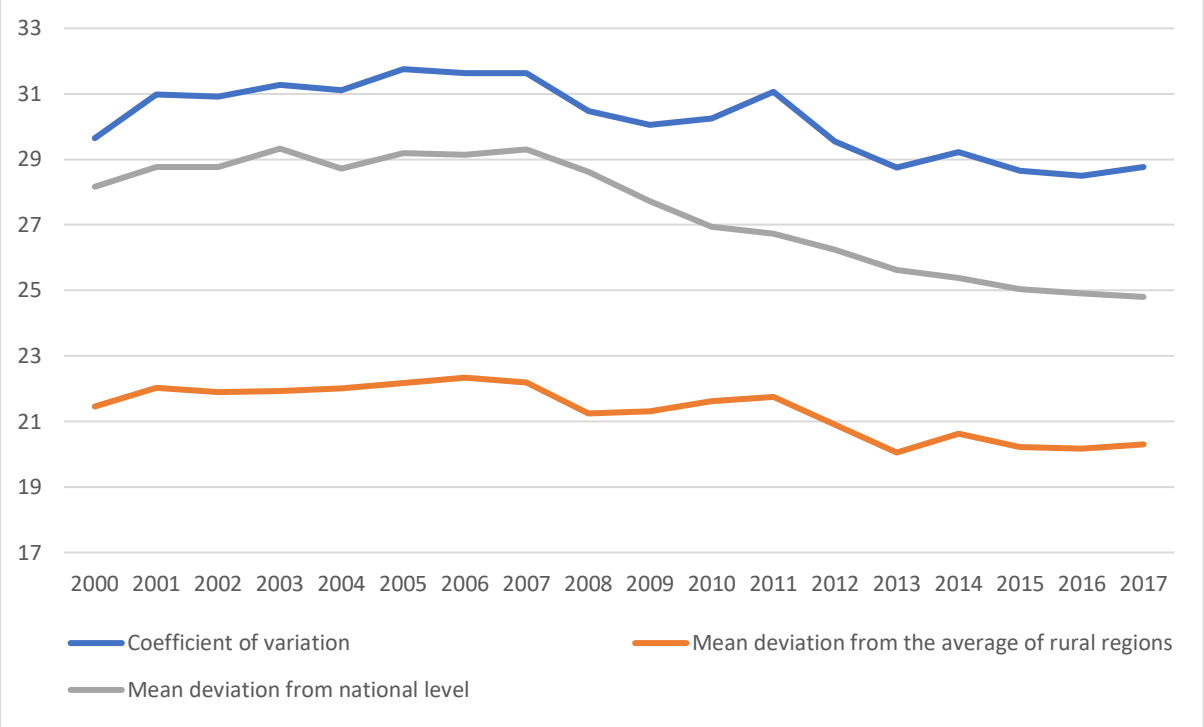

Figure 3.4: Measurements of regional disparities in GDP per capita for rural regions in Germany, 2000-2017

Source: Own calculations using data from Eurostat

The studies done on regional disparities in Greece have focused on the core-periphery nature of the economy with much of the population, wealth and investment concentrated in Athens. Caraveli and Tsionas (2012) note the "restrictive macro-economic measures adopted from the mid-80s" as being a cause for the widening of regional disparities. Petrakos and Saratsis (2000) find that, unlike other countries in Europe, regional disparities have a pro-cyclical trend, i.e. regional disparities in Greece tend to increase during boom years and decrease during recessionary years. Goletsis and Chletsos (2011) create a composite indicator to measure regional development in Greece for the years 1995 to 2007. They find no sign of convergence and again find that the Greek economy is characterised by a core-periphery nature with Attiki (the capital region) on a different growth path to the rest of the economy. There has been little research into the difference in development for rural regions in Greece.

Figure 3.5 shows the three measure of regional disparities for Greek rural regions. The coefficient of variation and the mean deviation from the average were falling until 2010 and 2011, both a sign of diminishing regional disparities among rural regions, and then stabilised or increased slightly. The mean deviation from the national level increased until 2008, which

is a sign of rural regions falling behind the national level, and then stabilised. These figures suggest that before the crisis although rural regions in Greece were becoming more equal among themselves, they were falling behind the urban and intermediate regions in terms of economic strength. Since the crisis there has been a general stabilisation in the trends.

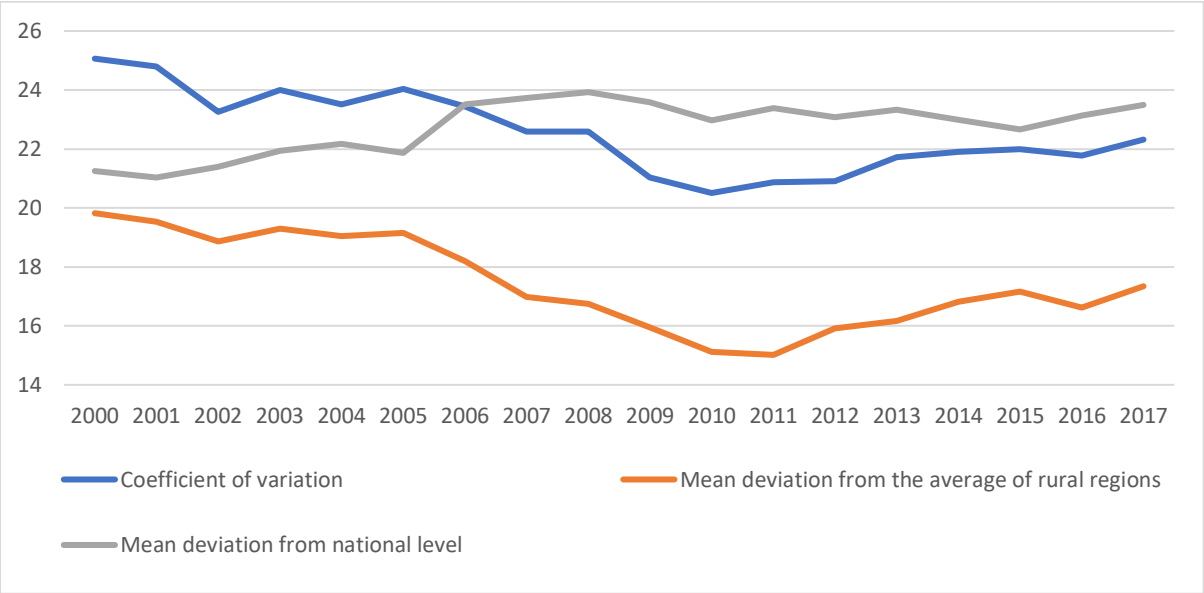

Figure 3.5: Measurements of regional disparities in GDP per capita for rural regions in Greece, 2000-2017

Source: Own calculations using data from Eurostat

3.5 Convergence Testing for Rural Regions

Convergence is one of the central ideas in economic theory, as was discussed in the literature review with the five economic growth theories (section 2.1). It is the main conclusion from the Solow growth model and there has been a number of empirical studies done exploring the idea of convergence between countries and between regions (Baumol, 1986; Barro and Sala-i-Martin, 1992; 2004). The sub-genre of urban economics has been also developed to explain the dynamic process of urban growth (Miron, 1975). In contrast, there remains a glut in the literature when it comes to the analysis of rural economies. The following is an examination of the convergence process of 327 EU rural regions (urban and intermediate regions have been removed from the sample). The convergence process has been examined through the standard β-convergence testing as has been explained in the methodology section (Barro, 1997, Dyba, et al. 2018).

The convergence testing was done for three time periods. The first regression model (model 3.1) analyses the convergence effect over the full time period for which data was available which is 2000 to 2017. Due to the financial crisis in 2008 it was felt necessary to then divide this into two time periods and redo the tests for both time periods (this is similar to the method by Smętkowski, 2018). Model 3.2 analyses the convergence during the pre-crisis time period (2000-2008). Model 3.3 analyses convergence during the post-crisis time period (2008-2017). After completing the process for all EU rural regions, it is then important to analyse the convergence at a national level for our two sample countries: Germany and Greece. Model 3.4 analyses convergence from 2000 to 2017 for rural regions in Germany. Model 3.5 analyses the convergence of rural regions in Germany in the pre-crisis time period (2000 to 2008) and model 3.6 analyses the convergence in the post-crisis period (2008 to 2017). Model 3.7 analyses the convergence of rural regions in Greece over the full time period (2000 to 2017) while model 3.8 and model 3.9 analyse the convergence during the pre-crisis time period (2000 to 2008) and the post-crisis time period (2008 to 2017) respectively. The results of all nine regressions are displayed in table 3.3.

Understanding the presence and prevalence of convergence is important to address the first research question but it is also important step towards addressing the goal of the thesis which is to understand the dynamics and spatial polarisation of rural regions. Understanding convergence before and after the crisis will show if rural polarisation has been increasing or decreasing and if the financial crisis of 2008 had a structural impact o n the economies of rural regions.

Table 3.3: Beta-convergence testing for rural regions in the EU, Germany and Greece

	EU			**Germany**			**Greece**		
	(3.1)	**(3.2)**	**(3.3)**	**(3.4)**	**(3.5)**	**(3.6)**	**(3.7)**	**(3.8)**	**(3.9)**
Variables	Full (00 - 17)	Pre-crisis (00 - 08)	Post-crisis (08 - 17)	Full (00 - 17)	Pre-crisis (00 - 08)	Post-crisis (08 - 17)	Full (00 - 17)	Pre-crisis (00 - 08)	Post-crisis (08 - 15)
Ln(GDP per capita 2000)	-0.0480***	-0.0608***		-0.0122***	-0.0107**		-0.0141**	-0.0273*	
Ln(GDP per capita 2008)			-0.0165***			-0.0081**			-0.0147*
N	327	327	359	110	110	110	29	29	29
R^2	0.5783	0.6734	0.1199	0.0995	0.0543	0.0451	0.2104	0.132	0.099

Source: Own calculations using data from Eurostat (=significant at 90%; **=significant at 95%; ***=significant at 99%)*

Regression 3.1 shows the effect that the log of GDP per capita in 2000 had on the average annual growth rate from 2000 to 2017. The coefficient is negative and statistically significant at the 99% level which indicates that there has been strong convergence. After dividing the timeframe into two periods, which can be described as pre-crisis and post-crisis, the regression analysis shows the that the log of GDP per capita in 2000 had a negative and statistically significant effect on the pre-crisis annual growth rate (model 3.2). The final regression for all the EU rural regions (model 3.3) shows that the log of GDP per capita in 2008 had a negative and statistically significant effect on the annual post-crisis growth rate. As can be seen the coefficient is negative and statistically significant for all three regressions. However, the coefficient is much stronger for the pre-crisis period compared to the post-crisis period. The R^2 is also much stronger, 0.67 for the pre-crisis period compared to 0.12 for the post-crisis period. This indicates that although convergence existed throughout the full time period the recession has caused the convergence to slow down dramatically. Convergence was stronger in the pre-crisis period and therefor the crisis of 2008 likely had a disrupting impact on the convergence of rural regions in Europe.

The regression analysis was also conducted for the rural regions of the two selected countries, namely Germany and Greece. The findings were similar to those for all the EU rural regions. In both Germany and Greece there was convergence throughout the full time period but it was stronger for the pre-crisis level. For Germany the coefficient was statistically significant at the 99% level for the full time period (model 3.4), but fell to 95% significant level for the two shorter time periods. The coefficient fell from -0.011 for the pre-crisis period (model 3.5) to -0.008 for the post-crisis period (model 3.6). The R^2 was low for the three regressions for Germany, likely due to the lower number of observations. This shows that convergence was stronger in the pre-crisis period compared to the post-crisis period, but the drop was not as dramatic as was shown in the whole of the EU. This was similar for Greece. In this case the coefficient fell from -0.027 in the pre-crisis time period (model 3.8) to -0.015 in the post-crisis period (model 3.9) and the R^2 fell from 0.13 to 0.1 which again shows that convergence slowed in the post-crisis period. The results for both Germany and Greece were less statistically significant than the results for the whole of the EU but this was likely to do with the lower number of observations (110 in Germany and 29 in Greece).

The important conclusion here is that although we can see convergence of rural regions across the EU, this has been hindered strongly since the global financial crisis of 2008. The results for two individual countries, Germany and Greece, emulated this, even though both

countries were affected in much different ways by the recession of 2008. This indicates that initial levels of GDP per capita was less important for economic growth of rural regions in the post-crisis period. Section 3.6 will explore some of the socio-economic factors that aided economic growth of rural regions in the post-crisis period.

3.6 Determinants of Economic Growth in Rural Regions

Although the Solow growth model (Solow, 1956) predicts convergence among regions, which was shown to exist to some degree in the previous section, the development of the endogenous growth model (Romer 1986; 1990) predicts that there will be conditional convergence depending on the endogenous factors. This section will explore some possible socio-economic factors that contribute to the economic growth of rural regions. This is an important step in addressing the research goal and it will show what are some of the socio-economic characteristics of economically successful rural regions and what characteristics might cause the polarisation of rural regions.

To understand what the further determinants of economic growth in rural regions are, i.e. what are the socio-economic characteristics that cause economic growth in rural regions, OLS regression analysis was used. The dependent variable is the average growth rate of rural regions between 2008 to 2017. The independent variables are those described in section 3.2. In total four regression models were conducted. The results from these regression models are presented in table 3.4.

Table 3.4: OLS regression average annual GDP per capita (2008-2017) growth of rural regions in the EU

	Average Annual GDP per Capita Growth 2008 – 2017			
Variables	**(3.10)**	**(3.11)**	**(3.12)**	**(3.13)**
Ln (GDP per Capita 2008)	-0.0139***	-0.0152***	-0.0172***	-0.0111***
Ln (Patents)	0.0003**	0.0003**	0.0002	0.0002**
Tourism	0.02**	0.0153*	0.0175**	0.0035
Agriculture	0.1229***			
Industry	0.1461***	0.0264**	0.276**	-0.0046
Construction	0.1585***	0.0217	0.0049	-0.03
Retail	0.0032	-0.0959***	-0.0907***	-0.0338*
Finance	0.1606***	0.0617	0.0819**	-0.036
Public Admin	0.1320***	0.0095	0.0000	-0.03**
Median Age	-0.0136	-0.0139	-0.0353**	0.0041
Education	-0.0002	-0.0003*	-0.0003**	-0.0001
Population Density	0.0011	0.0008	-0.0012	0.0013
Hospital Beds	0.0035***	0.0034***	0.0025***	-0.0032***
Crime	-0.0022***	-0.0024***	-0.021**	-0.0007
Germany dummy			0.011***	
Greece dummy				-0.0316***
N	327	327	327	327
R^2	0.5473	0.5328	0.5464	0.6341

Source: Own calculations using data from Eurostat (=significant at 90%; **=significant at 95%; ***=significant at 99%)*

Model 3.10 includes fourteen independent variables, ten of these variables are statistically significant. Out of the ten significant variables, only two of them had a negative impact on economic growth: initial level of GDP per capita and the crime rate. The other eight significant variables all had a positive impact on economic growth: patents, tourism, agriculture, industry, construction, finance, public administration and the number of hospital beds. The R^2 for this model was 0.55. There was however signs of multicollinearity with this model, that is to say some of the independent variables are highly correlated. The variance inflation factor (VIF) was used to determine the multicollinearity.

To mitigate the effects of multicollinearity, model 3.11 uses a VIF cut-off of 5, i.e. any independent variable with a value of greater than 5 was dropped from the model. This meant that agriculture was dropped from model 3.11. Therefore model 3.11 consisted of thirteen independent variables, eight of which were statistically significant. Four of these variables had a negative impact on economic growth of rural regions: initial level of GDP per capita, employment in retail, the crime rate and education. The four independent variables which had a positive impact on economic growth of rural regions were: patents, tourism, industry, and hospital beds. The R^2 was 0.53, similar to model 3.10.

Model 3.12 includes a location variable for Germany and model 3.13 includes a location variable for Greece. The location variable for Germany in model 3.12 is positive and statistically significant. This implies that there is an inherent advantage for rural regions in Germany in terms of economic growth. The location variable for Greece in model 3.13 is negative and statistically significant. This indicates that, when all the other variables are held constant, rural regions in Greece grew slower economically.

Similar to the β-convergence test conducted earlier in this chapter we can see that there has been convergence, i.e. the poorer regions have been growing stronger. This is evident from the negative and statistically significant impact of Ln(GDP per capita for 2008). In terms of the different sectors in the economy there are some interesting findings. Agriculture appears to have a positive effect in model 3.10 but suffers from multicollinearity and is consequently dropped for the second model. Tourism and employment in industry have positive impact on economic growth, while employment in retail has a negative impact.

In terms of human capital, we have two variables median age and education. Median age has no impact on growth while education surprisingly has a slightly negative impact. However, the impact is only significant at the 90% level and so should not be considered a

definitive conclusion. For place-based variables we have population density and hospital beds. Population density is used as a measure for rurality but is not significant in determining economic growth. Hospital beds are used as a proxy for access to services and this shows that the number of hospital beds per population in the rural regions has a positive and statistically significant impact on economic growth. From this we can assume that more accessible rural regions i.e. regions with better access to services, are more likely to experience economic growth. We include the crime rate as a measure of trust in the community i.e. we assume that regions with high crime rate will have low trust. This result shows that regions with higher crime rates suffered slower economic growth. The results for the location variables for Germany and Greece in model 3.12 and model 3.13 respectively, highlight the importance of national setting in terms of economic growth.

3.7 Summary

The mainstream economic theories often ignore the plight of rural regions. This chapter set out to use the foundation of economic theory and some common economic techniques to understand regional disparities, convergence and economic growth across rural regions in the EU and specifically in Germany and Greece. There are a number of interesting findings that can be drawn from the above analysis in terms of the current condition of rural regions, the trend over time and the characteristics of economically successful rural regions.

The analysis has shown that over the time period 2000 to 2017 there has been convergence among rural regions, i.e. poor rural regions have been growing faster than rich rural regions. This however is not as straightforward as it may appear. Further analysis has shown that the convergence effect was much stronger in the pre-crisis years and has slowed down drastically since the recession. This likely means that weak rural regions suffered more from the crisis and have been slower to return to growth. This result was also found for both Germany and Greece, two countries that were affected to much different extents by the financial crisis. Further analysis on both countries showed that rural regions in Germany are catching up to the urban and intermediate regions however rural regions in Greece are stagnating.

When we extend our OLS regression to include numerous other variables we have some interesting findings regarding what characteristics that cause economic growth. There are still strong signs that convergence is taking place with weaker regions growing faster. Innovation

is an important contributor to growth. Higher employment in industry results in stronger growth while employment in retail has a negative impact on growth. The number of hospital beds per population has a positive impact on growth. This is the result that would have been expected as hospital beds are seen as a proxy for access to services. This shows that accessibility is important for economic growth while more remote and peripheral regions are likely to suffer weaker growth. The measure for social capital (crime rate) has the impact I would expect as it has a negative impact. Possibly the most important conclusion from this chapter is the importance of location for economic growth. We see from our models that rural regions in Germany had an inherent advantage in terms of economic growth. However, rural regions in Greece suffered in terms of economic growth. This shows the importance of national setting for rural regions.

4 Structural Strength of European Rural Regions

4.1 Introduction

The purpose of this chapter is to address the second research question: What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions? The previous chapter focused mainly on GDP per capita (PPS) as an indicator of economic strength. Recently there has been an emphasis on the need to move beyond the use of GDP as the sole measure of economic success (Stiglitz et al. 2018). GDP is seen as one-dimensional and is unable to capture the complexity of development and hence there have been attempts to develop other, alternative measures of economic development such as the United Nations Human Development Index (HDI). There has also been an increase in academics developing synthetic indexes in an attempt to capture the complexity of economic development. A good example is Jakubowski's (2018) creation of a regional development index to measure "the multifaceted nature of development processes and cohesion policy" (p. 31). In his work he creates a synthetic index using ten variables which are inline with the three objectives of EU cohesion policy (smart, sustainable and inclusive growth) and calculates the index for 262 EU NUTS 2 regions from 2004 to 2014. He finds that, using this new measure, there was convergence between the new EU member states of Central and Eastern Europe and the older member states.

So far there have been sparse attempts to develop an index capturing the nature of rural development. Michalek and Zarnekow (2012) created and applied a rural development index for rural regions in Poland and Slovakia. Despite certain progress that the index offer in terms of measuring the economic development of rural regions, it is burdened with some weaknesses. Firstly, the indicators used to create the index differ for both countries. Additionally, the indicators used for creating the index do not remain constant over time, which impairs the possibility of international and time comparisons. This is a comprehensive index which they apply to NUTS 4 regions in both countries. Overall they use 991 indicators for the rural development index they apply to rural regions in Poland and 337 indicators when creating a rural development index for Slovakia. The size of this means that it would not be practical to be applied by policy makers.

Abreu et al. (2019) developed a rural development index for Portuguese municipalities (municipalities in Portugal are smaller than NUTS 3). They then apply this index to fifteen municipalities from the NUTS 3 region of Alto Alentejo. For the creation of this index they

use 16 indicators across four categories (population, social, economic and environment). This index has the clear advantage that it is relatively easy to create and can therefore be applied by policy makers. The clear limitation of their index lies in the fact that it is based on the Portuguese census which is done every ten years. This means that the index cannot be measured on an annual basis.

The research presented in this chapter aims to fill the gap in the literature by using OECD's *Handbook on constructing composite indicators* (2008) to develop an index that captures the structural strength of rural regions (the SSRR index). This index is created in a way that will allow for it to be measured annually and which allows for international comparisons. The chapter is structured as follows: section 3.2 will provide the theoretical framework for developing the index, section 3.3 will describe the methodology used in constructing the index, and the data used. Section 3.4 will analyse the results of the index at an EU level as well as the factors that contribute to a structurally strong rural region, while section 3.5 will present the results at a national level for Austria and Portugal and provide some details on individual rural regions. Section 3.5 will summarise the main conclusions from the analysis.

4.2 Theoretical Framework

Rural regions are often seen as lagging or economically weak, with less opportunities for the younger population. The OECD (2006) has labelled this as the "circle of declining rural regions" (see figure 4.1). In the circle of decline, rural regions start with a low population density. This low population density means that is a lack of critical mass for services and infrastructure means that the government reduces investment into improving public services and maintaining the infrastructure leading to decline in these areas. The neglect of local services and infrastructure means that starting a business becomes difficult and less profitable as these services and infrastructure are necessary for the success of local businesses. This lack of investment from the government therefore results in a lower rate of business creation from the community as the local population don't invest into creating businesses. The lower rate of business creation means that there are fewer job opportunities for the younger population. Fewer jobs mean that the young population must migrate to urban regions in the hope of securing employment. This out-migration results in an ageing population and further extenuates the low population density of rural regions which causes the rural region to fall into this circle of decline.

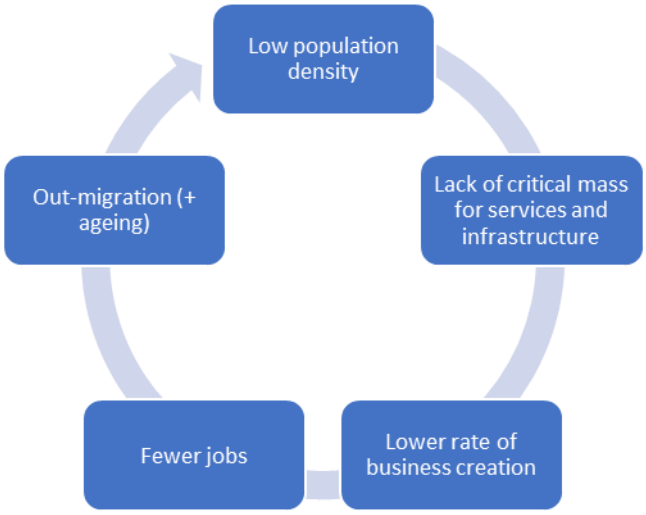

Figure 4.1: The circle of declining rural regions

Source: Adapted from OECD (2006)

The important aspects of this circle of decline emulate Petrick's model of neo-endogenous rural development (2013) which is presented in more detail in section 2.2.2 of the literature review. In the circle of decline the important aspects, especially in terms of what the local residents can contribute are business creation and in-migration. We see that lack of business creation leads to out-migration which further diminishes the likelihood of successful businesses. In Petrick's work (2013) the rural coordination game consists of two groups (this is presented in table 2.2 on page 27). One group is the mobile group. This group is the younger, well-educated population that lack financial resources. The other group is the immobile which is the older population. They have better financial resources but lack the skills that would be beneficial in urban regions or have too many ties in the rural region. Each group has two strategies. The mobile can either stay in the rural region or migrate to the urban region. The immobile can either invest locally or abstain from investing.

As shown in table 2.2, there are two equilibrium outcomes. One equilibrium outcome is that the immobile abstains from investing and the mobile moves to the urban region. This is similar to a rural region being trapped in the circle of decline. The lack of investment forces the young to out-migrate, which further prevents successful business creation. The other equilibrium outcome is when the immobile invests locally and the mobile stays in the rural

region. In this outcome, the investment means that the mobile group can stay in the rural region because there will be job opportunities and the immobile can further invest as the larger population means that investment is more likely to be profitable. This outcome is breaking the circle of decline of rural regions.

4.3 Methodology

In order to measure the structural strength of rural regions, the *Structural Strength of Rural Regions Index* (the SSRR index) was developed. Four indicators were selected to develop the SSRR index: GDP per capita, employment, net business creation and crude rate of net migration. The importance of these indicators for rural regions have been highlighted by the work of Bryden (2003). GDP per capita (PPS) and employment rate are used as they represent the productivity of the local economy. Net business creation and crude net migration rate are used as these appear as important indicators in both the OECD's "circle of declining rural regions" (2006) and Petrick's model of rural development (Petrick, 2013). Net business creation is seen as evidence that those with financial means have belief in the stability of the local economy and are willing to invest in it. Net migration is an important measure as it may present out-migration or in-migration. Out-migration is seen as evidence that the young population don't see a future for themselves in the region and feel the need to leave in order to pursue better opportunities. In-migration on the other hand is an indicator that opportunities exist within the region and people are willing to relocate there. A breakdown of the data and the calculation method are presented in table 4.1.

Table 4.1: Indicators used for the rural development index

Indicator	**Calculation**	**Source**
GDP per capita (PPS)	No calculation needed	Eurostat
Employment	$\frac{Number\ of\ persons\ employed}{Population\ (15\ to\ 64\ years)}$	Eurostat
Net Business Creation	$\frac{Births - Deaths\ of\ enterprises}{Population\ (15\ to\ 64\ years)}$	Eurostat
Crude rate of net migration	No calculation needed	Eurostat

Source: Own Work

In order to create the index, the TOPSIS method has been used. This method was developed by Hwaang and Yoon (1981) and was used for creating synthetic indicators for regional development by Malinowski (2019) and Pawlewicz et al. (2020). In our study the following six steps were followed in order to create the SSRR index:

Step 1: The four indicators mentioned above were normalised. This is necessary in order for the indicators to be comparable. The formula for this is:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (1)$$

Where

r_{ij} = the normalised value of the j^{th} indicator for the i^{th} region,

x_{ij} = the non-normalised value of the j^{th} indicator for the i^{th} region.

Step 2: Weights were applied to each indicator. As the four indicators are to be weighted evenly, they were each given a weight of 0.25.

At this point the summation of the values of the four indicators gives us a score between 0 and 1. This is a raw breakdown of the scores for the SSRR index.

Step 3: The ideal (A^+) and negative-ideal (A^-) solutions were determined. As the four indicators are all stimulants this means that the maximum value was used as the ideal solution and the minimum value was used as the negative ideal solution. These formulas can be written as:

$$A^+ = (v_1^+, v_2^+, \cdots, v_n^+)$$

$$A^- = (v_1^-, v_2^-, \cdots, v_n^-)$$

Where v_j^+ = maximum v_{ij} and v_j^- = minimum v_{ij}.

Step 4: The separation measure was calculated. This was done by calculating the Euclidean distance between each variable and the ideal and negative-ideal solution. The formula for calculating the distance from the ideal solution is:

$$s_{i^*} = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2} \tag{2}$$

The formula for calculating the distance from the negative-ideal solution is:

$$s_{i^-} = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \tag{3}$$

Step 5: The relative closeness to the ideal solution was calculated. This was done with the following formula:

$$C_{i^*} = \frac{s_{i-}}{(s_{i^*} + s_{i-})}, \quad 0 < C_{i^*} < 1. \tag{4}$$

Step 6: The rural regions were divided into classes based on their results using the arithmetic mean and standard deviation. This is the same method as used by Fura and Wang (2017) and Pawlewicz et al. (2020). The classes were divided by the following criteria:

- Class I – structurally strong rural region when $C_i \geq \bar{C}_i + S_{C_i}$;
- Class II – moderately strong rural region when $\bar{C}_i \leq C_i < \bar{C}_i + S_{C_i}$;
- Class III – moderately weak rural region when $\bar{C}_i - S_{C_i} \leq C_i < \bar{C}_i$;
- Class IV – structurally weak rural region when $C_i < \bar{C}_i - S_{C_i}$;

Where

C_i = value of SSRR index calculated with the TOPSIS method,

$\bar{C}_i$ = arithmetic mean of the SSRR index,

S_{c_i} = standard deviation of the SSRR index.

The following section calculates the SSRR index for all available rural regions across the EU for each year between 2008 and 2015. This time period was chosen as it has the largest available quantity of data and presents a large enough time period to understand the dynamics of structural strength and structural weakness in rural regions in Europe. The SSRR index was calculated for 153 rural regions across fourteen EU countries[5]. These were all the countries in the EU which had all necessary data in order to calculate the SSRR index. To understand the determinants of structural strength in rural regions OLS regression analysis is used. The dependent variable used is the SSRR index for 2015 while the independent variables are a selection of variables that provide an insight into the economy, people, place and community of the rural regions. Further information regarding these independent variables is provided in the methodology section of the previous chapter (section 3.2).

4.4 Structural Strength of Rural Regions across the European Union

The necessary data to complete the SSRR index is available for 153 rural regions across fourteen EU countries from 2008 to 2015. Table 4.2 provides a breakdown of the descriptive statistics for the SSRR index for those fourteen countries. In 2008 the minimum figure was 0.25, increasing to 0.28 in 2010 and then 0.30 in 2012. The minimum then fell to 0.13 in 2014 before increasing again to 0.22 in 2015. This is slightly volatile year-to-year but over the course of the eight years there was no sign of an upward or downward trend. The maximum figure was 0.81 in 2008 and increased to 0.84 in 2009 but fell to 0.73 in 2011. It increased again to 0.82 in 2012. The largest change was between 2012 and 2013 when the maximum figure fell from 0.82 in 2012 to 0.60 in 2013. By 2015 the maximum figure had increased to 0.77. Similar to the minimum figure, the maximum figure showed volatility over the timeframe but did not show a trend in either direction. The mean figure was similar to the minimum and maximum, it did not show a trend in either direction but did show some year-on-year changes. The highest years for the mean were 2009 and 2010 when it was 0.49 for both years. The years with the lowest means were 2013 and 2014 with means of 0.37 and 0.33 respectively. The standard deviation was 0.11 for the majority of the time period. It did increase to 0.12 for 2010 and

[5] Austria, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Hungary, Italy, Latvia, Portugal, Romania, Slovakia and Spain.

2012, and it fell to 0.10 for 2013 and 2014. The consistency of the standard deviation is an indication that there was not much deviation in the spread of the results over the time period. Similarly, the coefficient of variation changed year-on-year did not show any sign of growing or diminishing differences over the course of the time period

Table 4.2: Descriptive statistics of SSRR index for 14 EU countries, 2008 - 2015

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Minimum	0.25	0.25	0.28	0.27	0.30	0.19	0.13	0.22
Maximum	0.81	0.84	0.83	0.73	0.82	0.60	0.71	0.77
Mean	0.47	0.49	0.49	0.45	0.48	0.37	0.33	0.45
Standard deviation	0.11	0.11	0.12	0.11	0.12	0.10	0.10	0.11
Coefficient of variation[6]	24.29	22.15	24.86	23.88	24.03	26.19	28.79	24.96

Source: Own calculations using data from Eurostat

Table 4.3 shows the number and percentages of rural regions which fall into each classification during the time. The number of rural regions classified as structurally strong was highest in 2010 and 2011 with 30 and 32 rural regions being classified as structurally strong in these years respectively. That represents 20% of rural regions being classified as structurally strong in 2010 and 21% in 2011. The year with the lowest number of rural regions classified as structurally strong was in 2014 with only 23 rural regions being classified as structurally strong, this represents just 15% of all regions. The years with the most rural regions being classified as structurally weak were 2009 and 2013, when 28 rural regions were classified as structurally weak, which is equal to 18% of the rural regions. The year with the lowest number of rural regions being classified as structurally weak was 2015 when 13 rural regions were

[6] This is a synthetic measure of growing/diminishing spatial differences and is calculated by the formula: (σ/μ)*100

classified as structurally weak, which is equal to just 8%. It is important to note that over 50% of regions consistently fall into the categories of moderately weak and structurally weak. That is to say over 50% of rural regions fall below the average score for the SSRR index.

Table 4.3: Number and percentage of rural regions in each class for 14 EU countries, 2008 - 2015

Class	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
I – Structurally strong	27 *18%*	26 *17%*	30 *20%*	32 *21%*	25 *16%*	29 *19%*	23 *15%*	25 *16%*
II – Moderately strong	40 *26%*	43 *28%*	37 *24%*	36 *24%*	43 *28%*	43 *28%*	41 *27%*	34 *22%*
III – Moderately weak	64 *42%*	56 *37%*	66 *43%*	60 *39%*	62 *41%*	53 35%	73 *48%*	81 *53%*
IV – Structurally weak	22 *14%*	28 *18%*	20 *13%*	25 *16%*	23 *15%*	28 *18%*	16 *10%*	13 *8%*

Source: Own calculations using data from Eurostat

Table 4.4 shows the breakdown of how rural regions are classified across the fourteen different countries in 2015. Rural regions in Austria are shown to be particularly strong, 23 of the 24 rural regions in Austria are classified as structurally strong. This means that 23 of the 25 structurally strong rural regions across the fourteen countries are located in Austria. The final rural region in Austria is moderately strong, meaning that all rural regions in Austria are above average. The rural regions in Bulgaria are generally below average, 6 of the 7 rural regions in Bulgaria are classified as either structurally weak or moderately weak. All four rural regions in Czech Republic were classified as moderately weak, i.e. they were below average but none were classified as structurally weak. In Denmark the four rural regions were classified as either moderately strong or moderately weak, 3 of the rural regions were moderately strong and 1 was moderately weak. There are only 3 rural regions in Estonia, two of these were

classified as moderately strong and one was moderately weak. In Spain six of the ten regions were classified as structurally strong while the other four were all classified as moderately weak. The rural regions in Finland were on average slightly above average. Seven of the twelve rural regions were above average but only one of these was structurally strong. The remaining five were all moderately weak, none of the rural regions were structurally weak. In Croatia all rural regions were below average and the majority of rural regions were structurally weak (five of the thirteen rural regions were moderately weak and eight were structurally weak). In Hungary all of the rural regions are also below average but they don't have the same level of structural weakness, only one of the six rural regions were classified as structurally weak and the other five were all moderately weak. Italy has the largest spread in terms of classifications of rural regions but on average rural regions in Italy were below average. In Italy there was one structurally strong rural region and five moderately strong but the majority were weak, with fifteen rural regions in Ital classified as moderately weak and one classified as structurally weak. There are only two rural regions in Latvia and both were classified as moderately strong. The rural regions in Portugal were generally weak, twelve of the rural regions were classified as moderately weak and one was classified as structurally weak. Only three of the rural regions in Portugal were classified as moderately strong and none were classified as structurally strong. The rural regions in Romania were clustered around the average but were generally below average, twenty-three were moderately weak and just five were moderately strong. There are only three rural regions in Slovakia, one was moderately strong and two were moderately weak. Overall we can see that the rural regions in most countries were clustered between classes II and III (moderately strong and moderately weak). The two exceptions to that were Austria and Croatia. Austria had the largest proportion of rural regions classified as structurally strong, 96% of the rural regions were in the top classification. Croatia had the largest proportion of rural regions in the lowest classification group, 63% of rural regions in Croatia were classified as structurally weak.

Table 4.4: Classifications of rural regions in each country, 2015

	I – Structurally strong	II – Moderately strong	III – Moderately weak	IV – Structurally weak	Total
Austria	23 *96%*	1 *4%*	0 *0%*	0 *0%*	24 *100%*
Bulgaria	0 *0%*	1 *14%*	4 *57%*	2 *29%*	7 *100%*
Czech Republic	0 *0%*	0 *0%*	4 *100%*	0 *0%*	4 *100%*
Denmark	0 *0%*	3 *75%*	1 *25%*	0 *0%*	4 *100%*
Estonia	0 *0%*	2 *67%*	1 *33%*	0 *0%*	3 *100%*
Spain	0 *0%*	6 *60%*	4 *40%*	0 *0%*	10 *100%*
Finland	1 *8%*	6 *50%*	5 *42%*	0 *0%*	12 *100%*
Croatia	0 *0%*	0 *0%*	5 *38%*	8 *62%*	13 *100%*
Hungary	0 *0%*	0 *0%*	5 *83%*	1 *17%*	6 *100%*
Italy	1 *5%*	4 *19%*	15 *71%*	1 *5%*	21 *100%*
Latvia	0 *0%*	2 *100%*	0 *0%*	0 *0%*	2 *100%*
Portugal	0 *0%*	3 *19%*	12 *75%*	1 *6%*	16 *100%*
Romania	0 *0%*	5 *18%*	23 *82%*	0 *0%*	28 *100%*
Slovakia	0 *0%*	1 *33%*	2 *67%*	0 *0%*	3 *100%*

Source: Own calculations using data from Eurostat

The next challenge is to understand what are the socio-economic characteristics that determines the structural strength of these rural regions. For this, OLS regression analysis was used and the dependent variable was the SSRR index for 2015 (it is important to note that this analysis was only done for 2015 as this is the most recent year for which the data is available). The independent variables are those outlined in the section 3.2 of the previous chapter. In total five regression models conducted and the results of these are presented in table 4.5.

Regression model 4.1 uses fourteen independent variables, of which seven of these are statistically significant. Four of these significant independent variables had a positive impact on the structural strength of rural regions: the log of GDP per capita in 2010, the number of patents, the population density and the number of hospital beds. Three variables had a negative impact on the structural strength of rural regions: the proportion of the population employed in industry, finance and public administration. The R^2 for model 4.1 was high at 0.7. However the results of this model showed signs of multicollinearity i.e. some of the independent variables were highly correlated.

To mitigate the effects of multicollinearity, model 4.2 used a VIF cut-off of 10. This means that any independent variable which had a VIF greater than 10 was removed from the model. This resulted in just one variable being dropped which was the proportion of the population employed in agriculture. This means there was a total of thirteen independent variables used in model 4.2, five of which were statistically significant. Four of these significant independent variables had a positive impact on the structural strength of rural regions: the log of GDP per capita in 2010, the number of patents, the population density and the number of hospital beds. The only variable which had a negative impact on the structural strength of rural regions was the proportion of the population employed in industry. The R^2 remained high for model 4.2 at 0.7.

In order to further mitigate the effects of multicollinearity, model 4.3 used a VIF cut-off of 5. This means that any independent variable which had a VIF greater than 5 was removed from the model. This resulted in just one further variable being dropped which was the proportion of the population employed in finance. Model 4.3 then had a total of twelve independent variables, six of which were statistically significant. Four of these significant independent variables had a positive impact on the structural strength of rural regions: the log of GDP per capita in 2010, the number of patents, the population density and the number of hospital beds. Two variables had a negative impact on the structural strength of rural regions:

the proportion of the population employed in industry, and public administration. The R^2 was also strong for model 4.3 at 0.69.

Model 4.4 introduces a location variable for Austria and model 4.5 introduces a location variable for Portugal. These location variables are used to understand if rural regions in Austria and Portugal are more likely to be structurally strong than the average rural region in the EU. These two countries were selected as they will be studied further in the following sections of this chapter. For model 4.4 we see that the Austria variable had a significant and positive effect. This implies that rural regions in Austria are structurally stronger, even when all the other variables are accounted for, so there must be an inherent advantage of being located in Austria. Model 4.5 shows that the Portugal location variable was also positive. This means that there is also an advantage to be located in Portugal, however the value was less than a third of that for the Austria variable so rural regions in Austria have a bigger advantage compared with Portugal.

From these regression models there are a number of important findings that should be highlighted. GDP per capita in 2010 showed a positive relationship. This assumes that relatively rich rural regions in 2010 were more likely to be structurally strong in 2015. Patent applications had a positive effect. This is the result I would have expected as it shows that more innovative regions were more likely to be structurally strong. Tourism was not significant, meaning that regions with higher tourism were neither structurally stronger nor structurally weaker than rural regions without tourism. Similarly, construction, retail and finance were for the most part not statistically significant. In some of the models, employment in public administration had a negative impact on structural strength, as did employment in industry. This may be due to the fact that employment in these sectors are considered safe and therefore discourages the risk needed for investment and business creation in rural regions. For the measures of human capital, median age and education had no effect on structural strength. This is a surprise, as we would have expected a younger, more educated population would be beneficial for structural strength. For the place-based variables both population density and hospital beds had a positive impact. This means that more rural areas and regions with less accessibility suffer more from structural weakness. Crime was not statistically significant.

Table 4.5: OLS regression on SSRR index 2015 for rural regions in fourteen EU countries

	SSRR 2015				
Variables	**(4.1)**	**(4.2)**	**(4.3)**	**(4.4)**	**(4.5)**
Ln (GDP per Capita 2010)	0.1404***	0.1443***	0.1192***	0.0978***	0.1167***
Patents	0.0055***	0.0057***	0.0056***	0.002*	0.0055***
Tourism	-0.0184	0.0093	0.0156	0.0322	0.028
Agriculture	-0.3085				
Industry	-0.6971***	-0.3730***	-0.3530***	-0.1507*	-0.3563***
Construction	-0.1781	0.2441	0.2612	-0.0605	0.1914
Retail	-0.1151	0.0775	0.041	-0.0573	0.0544
Finance	-0.7673*	-0.5691			
Public Admin	-0.5456**	-0.2080	-0.3008**	-0.1426	-0.2998**
Median Age	0.0261	0.0237	0.0187	-0.216**	-0.0114
Education	-0.0007	-0.0006	-0.0004	0.0019*	0.0007
Population Density	0.0355***	0.0362***	0.0287***	0.0214**	0.0357***
Hospital Beds	0.0198***	0.0202***	0.0191***	-0.0005	0.0223***
Crime	-0.0069	-0.0063	-0.0071	-0.0039	-0.0074
Austria				0.1562***	
Portugal					0.0482**
N	153	153	153	153	153
R^2	0.7024	0.6977	0.6928	0.7648	0.7029

Source: Own calculations using data from Eurostat (=significant at 90%; **=significant at 95%; ***=significant at 99%)*

4.5 Structural Strength of Rural Regions in Austria and Portugal

Examining the structural strength of rural regions at an EU scale provides an important starting point for our analysis. However, as has been shown in the previous section, there is a strong correlation between the country within which a rural region is located and relative structural strength of a given region. The country factor can be influential for a number of reasons such as national institutions, culture, history and natural climate. These factors vary among countries within the EU and so for a more in-depth analysis it is important to verify the role of the country-level differences. This section will provide an analysis on the findings concerning the structural strength of the rural regions in Austria and Portugal, which differ in terms of their natural conditions, types of rural economy and institutional settings. Both countries have faced the issue of regionalisation. Austria's issue with regionalisation can largely be seen as being caused by historical factors, while Portugal's regionalisation is largely geographical in nature.

This section is divided into two subsections, one for each country. First the results of the SSRR index will be presented at a national scale over the period of 2008 to 2015, in order to understand the national trend. Following this there will be a further investigation into the results at a regional scale. This will be done by taking a sample of three regions from each country: one region which has been consistently strong, one which has been consistently weak and one which has shown strong signs of improvement over the time period.

4.5.1 Austria

During the Habsburg monarchy there were distinct regional disparities in Austria between the industrial west and agricultural east (Good, 1981). These disparities continued after the collapse of the monarchy and were accentuated in the post WW2 era as the eastern territories were occupied by Soviet forces until 1955. This meant that these regions were slower to avail of US funds and investments. Tödtling (1983) classified "peripheral less-developed areas" in Austria based on their degree of accessibility and level of development. He found that the peripheral less-developed areas "consist mainly of northern, eastern and southern border areas (bordering the Eastern European countries) and some mountain areas" (p. 401). In spite of many 'equalising' efforts of the Austrian government, taking advantage of EU cohesion funds, the differences in terms of the level of regional development remain noticeable also at present (cf. Kilper, 2009, Wink, et al. 2016, Neufeld, 2017). The border mountain areas seem particularly affected.

Table 4.6 shows the descriptive statistics of the SSRR index for the 24 rural regions in Austria from 2008 to 2015. The minimum figure was lowest in 2009 and 2011 when it was 0.12 and 0.13 respectively. The minimum was highest in 2014 when it was 0.23. Although this shows some variation, there is no sign of an overall trend for the minimum figure. The maximum figure was relatively stable from 2008 to 2013, only varying between 0.74 and 0.83. However, the maximum fell to 0.67 in 2014 and then 0.59 in 2015. The mean was lowest in 2009 when it was 0.35 and highest in 2013 when it was 0.48. From 2008 to 2012 the standard deviation was either 0.15 or 0.16 every year. It fell to 0.12 in 2013 and 2014 and fell further to 0.10 in 2015. This shows a trend towards the equalising of structural strength of rural regions in Austria. The coefficient of variation was highest in 2009 when it was 45.71. It was lowest in 2013 and 2015 when it was 25 and 24.39 respectively. Similar to the trend of the standard deviation, this is an indication of a general tendency to equalize spatial differences in the structural strength of Austrian rural regions.

Table 4.6: Descriptive statistics of SSRR index for Austria, 2008 - 2015

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Minimum	0.16	0.12	0.19	0.13	0.16	0.19	0.23	0.17
Maximum	0.80	0.81	0.79	0.74	0.83	0.80	0.67	0.59
Mean	0.42	0.35	0.42	0.39	0.42	0.48	0.44	0.41
Standard deviation	0.16	0.16	0.15	0.16	0.15	0.12	0.12	0.10
Coefficient of variation[7]	38.09	45.71	35.71	41.02	35.71	25.00	27.27	24.39

Source: Own calculations using data from Eurostat

[7] This is a synthetic measure of growing/diminishing spatial differences and is calculated by the formula: (σ/μ)*100

Table 4.7 shows the number and percentage of Austrian rural regions in each of the four classes from 2008 to 2015. The number of structurally strong rural regions varied between 4 and 5 from 2008 to 2012. However the number of structurally strong rural regions fell to a low of 3 in 2013 and 2015. The number of structurally weak rural regions was consistently 4 or 5 for every year from 2008 to 2015. There has been a slight change in the number of rural regions classified as either structurally strong or moderately strong, which was 50% or less from 2008 to 2012 but was greater than 50% from 2013 to 2015. This means that from 2008 to 2012 more than half of the rural regions in Austria were classified as moderately weak or structurally weak. This changed so that less than half of rural regions were classified as moderately weak or structurally weak from 2013 to 2015.

Table 4.7: Number and percentage of rural regions in each class for Austria, 2008 - 2015

Class	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
I – Structurally strong	4 *17%*	5 *21%*	5 *21%*	4 *17%*	4 *17%*	3 *13%*	4 *17%*	3 *13%*
II – Moderately strong	9 *38%*	5 *21%*	7 *29%*	6 *25%*	9 *38%*	9 *38%*	10 *42%*	10 *42%*
III – Moderately weak	6 *25%*	10 *42%*	7 *29%*	10 *42%*	7 *29%*	8 33%	5 *21%*	7 *29%*
IV – Structurally weak	5 *21%*	4 *17%*	5 *21%*	4 *17%*	4 *17%*	4 *17%*	5 *21%*	4 *17%*

Source: Own calculations using data from Eurostat

Figure 4.2 shows the geographical distribution of the SSRR index for 2008 and 2015 for Austria. The structurally strong and moderately strong rural regions are located in the eastern and south-eastern parts of the countries. The structurally weak rural regions are located in the south, near the border with Italy, which confirms the initial assumption/supposition that the border mountain areas seem particularly affected by structural weaknesses.

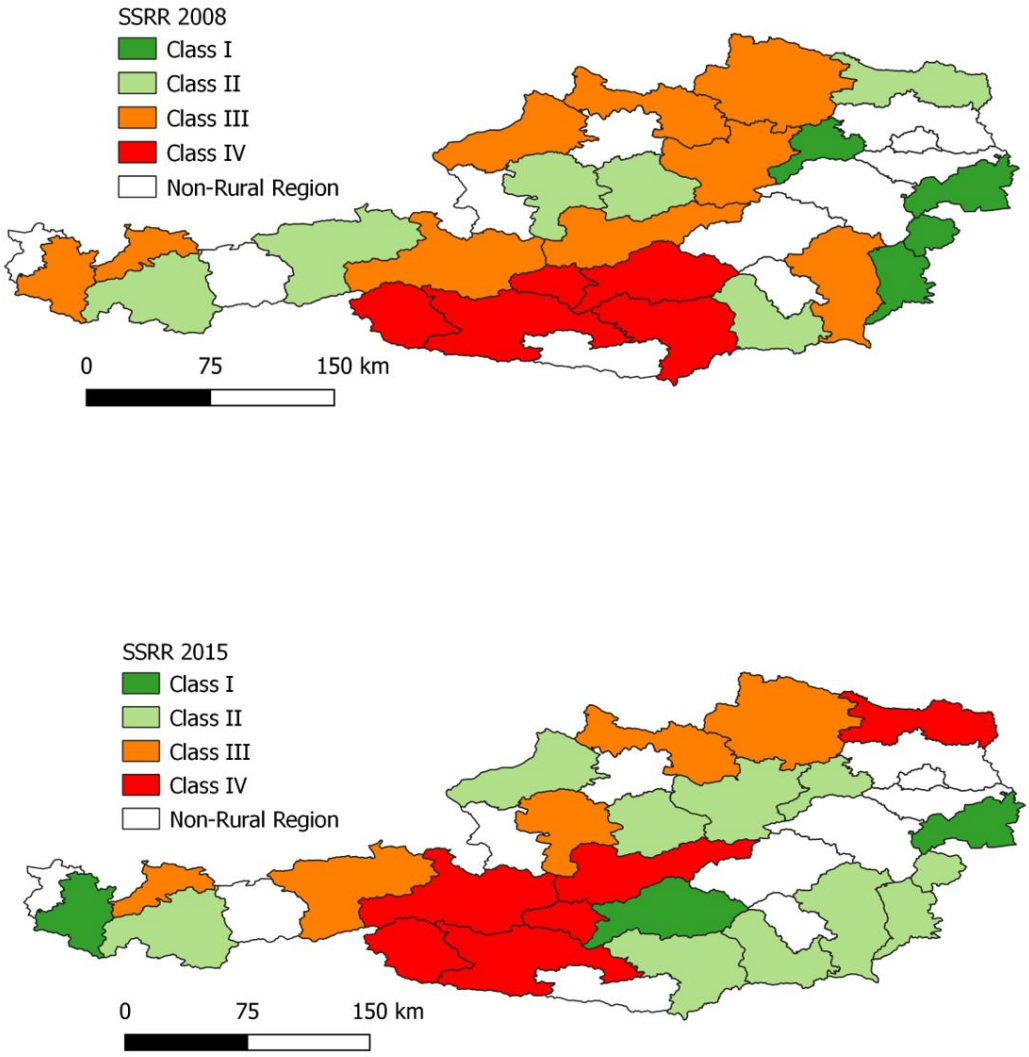

Figure 4.2: SSRR index results for rural regions in Austria, 2008 and 2015

Source: Own calculations using data from Eurostat

To further understand the changing dynamics of rural regions within Austria it is important to analyse the concept of structural strength and weakness at a regional scale. For that reason, a sample of three rural regions have been selected for further analyses: Nordburgaland, Westliche Obersteiermark and Osttirol. The geographical location of these regions is highlighted in figure 4.3. Nordburgenland was selected as an example of a structurally strong region. This region has remained structurally strong throughout the period 2008 to 2015. Located in the east of the country it borders both Hungary and Slovakia. It is

located near to both Vienna and Bratislava. Osttirol is an example of a structurally weak rural region and has been classified as such throughout the time period under investigation. It is a mountainous region, located in the south-west of the country, at the Austrian-Italy border. The final region under investigation is Westliche Obersteiermark. This region is located in the centre of the country and has improved from being considered structurally weak in 2008 to being considered structurally strong in 2015. It is important to understand the dynamic process which happened within this region as it illustrates that weak regions are not necessarily trapped or destined to a certain outcome.

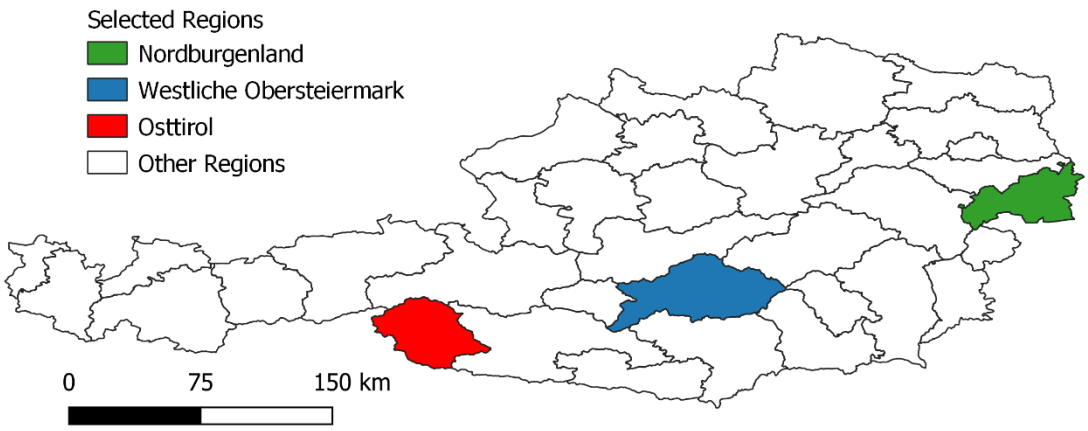

Figure 4.3: Selected rural regions in Austria for further analysis

Source: Own work

The SSRR scores for these three regions from 2008 to 2015 are shown in Figure 4.4. The graph shows some signs of convergence. This convergence is largely to do with the drop in the score for Nordburgenland. This fall for in the SSRR index for Nordburgenland occurred between 2013 and 2015 when it's score dropped from more than 0.8 to less than 0.6. However, it is important to note that even with the drop, Nordenburgenland was still classified as structurally strong in 2015. The score for Osttirol has increased slightly from less than 0.2 to approximately 0.3, however it remains structurally weak. The most remarkable change has been the strong increase witnessed by Westliche Obersteiermark. Westliche Obersteiermark

was approximately 0.2 in 2008 and increased to approximately 0.6 in 2015. This is an increase from structurally weak to structurally strong.

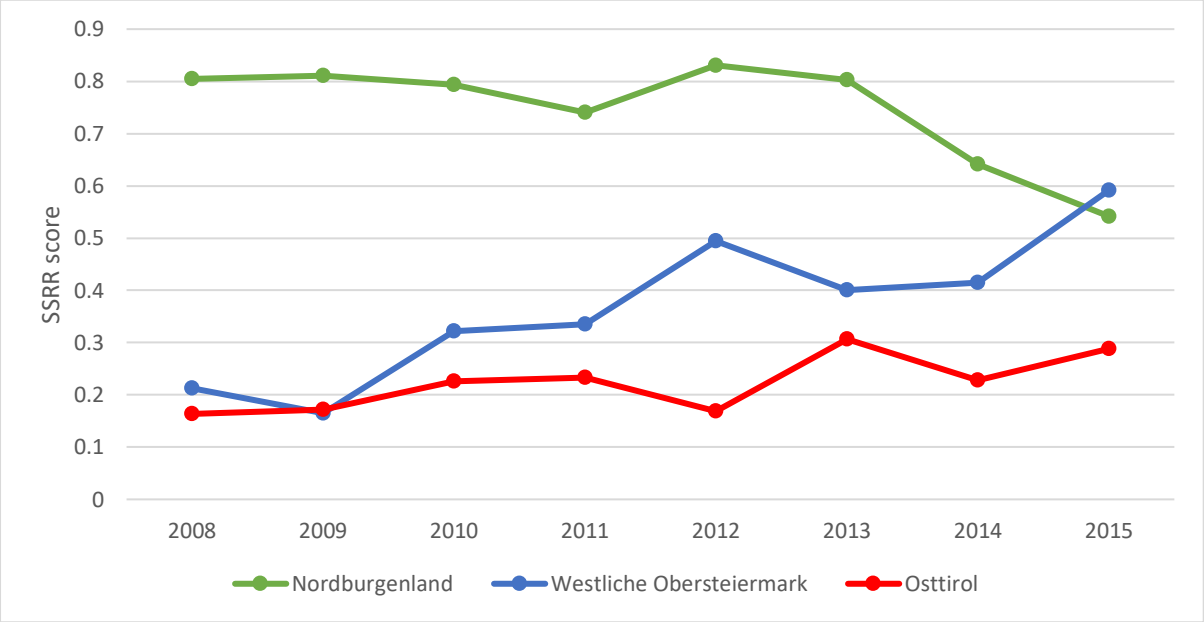

Figure 4.4: SSRR index results for selected Austrian rural regions, 2008-2015

Source: Own calculations using data from Eurostat

Table 4.8 shows a breakdown of the percentage of people employed in different sectors of the economy for Austria as a whole and each of the selected rural regions in 2015. What shows here is that Nordburgenland, the structurally strong region, had a smaller proportion of people employed in industry and more employed in retail and finance. What separates Westliche Obersteiermark, the improving region, and Osttirol, the structurally weak region, is less obvious.

Table 4.8: Employment in different sectors for Austria and selected rural regions in 2015

	Austria	Nordburgenland	Westliche Obersteiermark	Osttirol
Agriculture	4.1%	7.1%	9.3%	9.7%
Industry	16.0%	13.5%	23.0%	22.0%
Construction	6.6%	7.9%	6.3%	6.8%
Retail	29.5%	30.5%	24.8%	28.4%
Finance	15.9%	12.0%	8.4%	8.9%
Public Admin	27.9%	28.9%	28.1%	24.2%

Source: Eurostat

4.5.2 Portugal

The regional disparities in Portugal result from a 'littoralisation' process as wealth is concentrated in coastal regions, mainly along the Lisbon-Porto axis and the Algarve, while the inland regions have remained neglected and underdeveloped. This has been caused by the "absence of transfers of investments and of responsibilities to the peripheral zones and the impoverishment of the countryside, solely for the benefit of industrial growth in an urban environment without any true sharing or distribution" (Mayer 1981, p. 344). Lois-González (2007, p. 78), from analysing a Portuguese geography textbook, came to the conclusion that "Lisbon, the capital, is seen as the centre of the country, although the spotlight is cast on the Lisbon-Porto axis concentrating all the wealth, dynamism and population. There are frequent allusions to a *littoralization* process, the polarization of growth in coastal areas. Finally, the islands and the interior border areas are clearly marked as peripheral territories".

Table 4.9 shows descriptive statistics of the SSRR index for the 16 rural regions in Portugal from 2008 to 2015. The minimum was highest in 2009 when it was 0.36 and lowest in 2012 when it was 0.10. Although there is considerable changes year-on-year, the figure in 2008 (0.14) and in 2015 (0.12) were relatively similar so there is no indication of a trend during the time. The maximum was highest in 2012 (0.89) and lowest in 2013 (0.56) but again the figure in 2008 (0.77) was similar to the figure in 2015 (0.78). The mean was lowest in 2013 (0.36) and highest in 2014 (0.57), again showing no signs of a general trend over the time

period. The standard deviation varied between 0.1 and 0.2 and the coefficient of variation varied between 14.28 and 44.44. This figures showed no sign of a general trend.

Table 4.9: Descriptive statistics of the SSRR index for Portugal, 2008 – 2015

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Minimum	0.14	0.36	0.34	0.22	0.10	0.13	0.24	0.12
Maximum	0.77	0.61	0.68	0.72	0.89	0.56	0.82	0.78
Mean	0.36	0.49	0.48	0.40	0.47	0.36	0.57	0.45
Standard deviation	0.16	0.07	0.10	0.14	0.20	0.14	0.16	0.17
Coefficient of variation	44.44	14.28	20.83	35.00	42.55	38.89	28.07	37.78

Source: Own calculations using data from Eurostat

Table 4.10 shows the number and percentage of Portuguese rural regions in each of the four classes from 2008 to 2015. The number of regions classified as structurally strong varied between 2 and 4. The number of regions classified as structurally weak varied between 1 and 4. In general, more than 50% of regions were classified as moderately weak or structurally weak. The two years with the highest proportion of regions classified as structurally strong or moderately strong were 2014 and 2015 (57% in both years) which could be an indication that the situation has been improving.

Table 4.10: Number and percentage of rural regions in each class for Portugal, 2008 – 2015

Class	2008	2009	2010	2011	2012	2013	2014	2015
I – Structurally strong	2 *13%*	4 *25%*	2 *13%*	3 *19%*	3 *19%*	4 *25%*	3 *19%*	2 *13%*
II – Moderately strong	5 *31%*	3 *19%*	6 *38%*	4 *25%*	5 *31%*	3 *19%*	6 *38%*	7 *44%*
III – Moderately weak	7 *44%*	7 *44%*	5 *31%*	6 *38%*	7 *44%*	5 *31%*	4 *25%*	5 *31%*
IV – Structurally weak	2 *13%*	2 *13%*	3 *19%*	3 *19%*	1 *6%*	4 *25%*	3 *19%*	2 *13%*

Source: Own calculations using data from Eurostat

Figure 4.5 shows the geographical distribution of the SSRR index for 2008 and 2015 for Portugal. The rural regions which are classified as structurally strong and moderately strong, and which have improved over the time, are the regions on the coast and the regions which are located on the Lisbon-Porto axis. The rural regions that are classified as structurally weak and moderately weak are those which are located on the inland and bordered with Spain. This means that the process of 'littoralisation', mentioned at the beginning of the section, is still (and even more) clearly visible in Portugal.

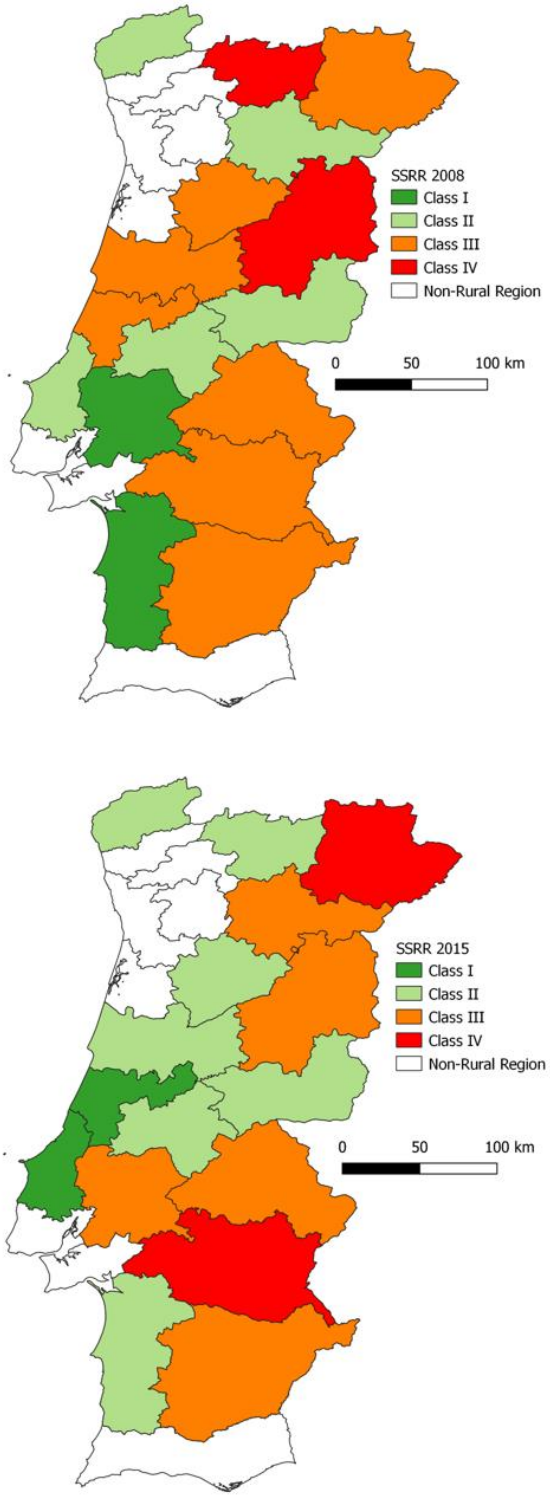

Figure 4.5: SSRR index results for rural regions in Portugal, 2008 and 2015

Source: Own calculations using data from Eurostat

To further understand the dynamics of rural development it is again important to analyse structural strength at a regional level. For Portugal we will again be taking a closer look at three rural regions. The geographical location of these regions is shown on figure 4.6. Oeste is one of the stronger rural regions in Portugal as it was classified as structurally strong for 5 out of the 8 years under investigation. Located on the western coast of Portugal, just north of Lisbon, Oeste is situated on the Lisbon-Porto axis. Alentejo Central was classified as structurally weak for 6 out of the 8 years from 2008 to 2015. Alentejo Central is located on the eastern part of the country and borders with Spain to the east, it is far from the core of the economy i.e. the Lisbon-Porto axis. The final region under investigation is Região de Leiria. In 2008 Região de Leiria was classified as relatively weak but has since improved considerably and in 2015 was classified as structurally strong. Located on the west coast of the country, Região de Leiria is north of Oeste and also lies on the Lisbon-Porto axis.

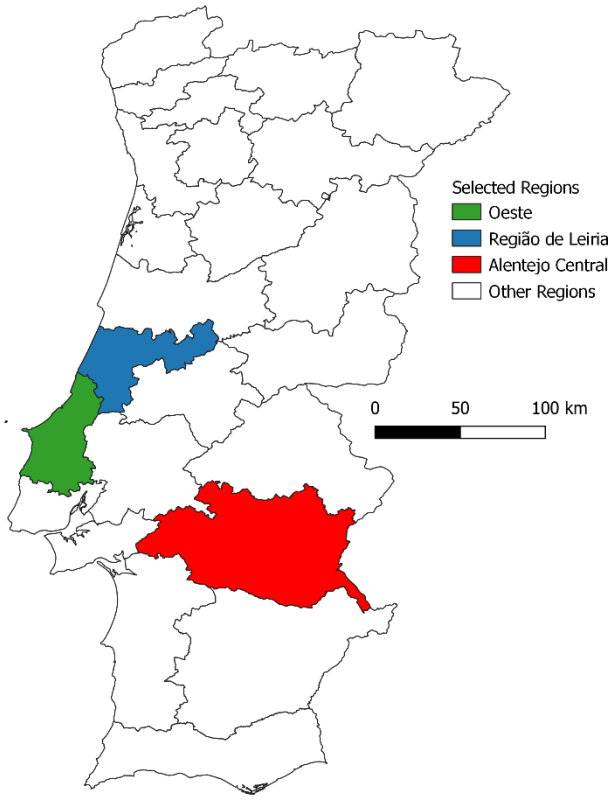

Figure 4.6: Selected rural regions in Portugal for further analysis

Source: Own work

The SSRR scores for these three regions from 2008 to 2015 are shown in figure 4.7. As can be seen from the graph there has been considerable divergence between the regions from 2008 to 2015. Oeste, which has been one of the stronger rural regions in Portugal, improved it's SSRR index from approximately 0.5 in 2008 to approximately 0.8 in 2015. Alentejo Central had a score of more than 0.2 in 2008, which increased to more than 0.3 in 2009 and 2010, but has since fallen to approximately 0.1 in 2015. Região de Leiria had the highest increase, increasing from approximately 0.3 in 2008 to over 0.7 in 2015. The difference between the SSRR scores for Oeste and Alentejo Central went from 0.25 in 2008 to 0.66 in 2015. This has been caused by both a downward trend for Alentejo Central and an upward trend for Oeste.

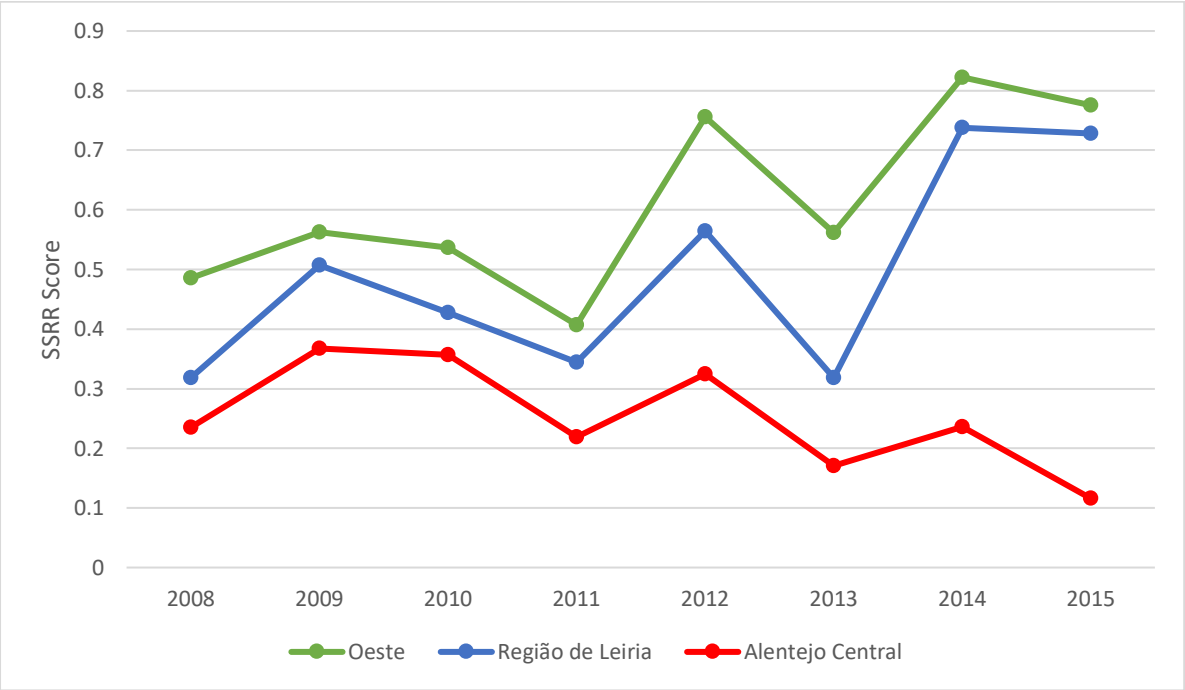

Figure 4.7: SSRR index results for selected Portuguese rural regions, 2008-2015

Source: Own calculations using data from Eurostat

Table 4.11 shows the breakdown of the percentage of people employed in different sectors of the economy for Portugal as a whole and each of the selected rural regions in 2015. What is immediately striking is the vast percentage of people in Oeste, the structurally strong region, employed in agriculture. Região de Leiria, which has been showing strong signs of improving its structural strength has a relatively large proportion of its population employed in industry and construction. Oeste and Região de Leiria are both located on the Lisbon-Porto

axis and so these sectors (agriculture, industry and construction) are likely to be either servicing the larger cities or benefitting from spill-over effects from the cities. Alentejo Central, the structurally weak region, is highly reliant on the public administration sector for employment. This is an indication that employment in the sector may result in dependence and be a hinderance to real development for rural regions. If employment in this sector is seen as safe then it will be a hinderance to risk taking behaviour which is essential for business creation and results in structural strength.

Table 4.11: Employment in different sectors for Portugal and selected rural regions

	Portugal	**Oeste**	**Região de Leiria**	**Alentejo Central**
Agriculture	10.7%	33.6%	10.2%	15.6%
Industry	16.8%	14.6%	25.6%	15.3%
Construction	6.0%	4.9%	9.4%	4.5%
Retail	26.8%	23.1%	25.6%	22.8%
Finance	13.4%	5.8%	8.7%	7.4%
Public Admin	26.9%	18.0%	20.3%	34.5%

Source: Own calculations based on data from Eurostat

4.6 Summary

The purpose of this chapter has been to address the second research question: What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions? In order to address this question it was necessary to provide an alternative measurement for structural strength of rural regions which goes beyond the traditional use of GDP per capita. The creation of the SSRR index has been an attempt to capture the complex and multi-faceted process of rural development. This new measure has provided us with a tool for understanding which rural regions can be classified as structurally strong and which can be classified as structurally weak. This measure can be calculated on an annual basis and therefore it is also possible to see the trend for improving regions. In this chapter the SSRR index was applied at an EU wide scale

which covered 153 rural regions in 14 countries. It was then applied to at a national level for two very different countries: Austria and Portugal. Analysis was done at both EU and national scale which provides us with interesting insights into the determinants of structural strength.

It is clear that place-based factors are important. From the regression analysis at the EU level in can be derived that population density and accessibility is important. There are levels of rurality and from this it is seems that more rural and less accessible regions are hindered in their development. For both Austria and Portugal it is evident that place is an important factor. In Austria the rural regions in the east and south-east are structurally stronger. This is possibly due to the proximity to Vienna. Another possible explanation for this shift is the EU enlargement in 2004. The countries on the eastern border with Austria (Slovenia, Hungary and Slovakia) joined the EU, which opened new trade routes and a large market for these rural regions. The EU supporting policy measures also facilitated this process. Meanwhile the structurally weak regions are the mountainous regions which border Italy. For Portugal inland regions are more likely to be structurally weak. The structurally strong rural regions and the rural regions that saw an improvement in structural strength are the regions on the coast or near the Lisbon-Porto axis. This is likely the result of increasing influence of Lisbon as the centre of the country, and the importance of it as the economic core of the country.

The structure of the local economy is important for developing structural strength in rural regions. On the EU scale it was shown that reliance on employment in industry and public administration had a negative impact on structural strength. It is likely that the younger population do not consider these to be attractive careers and therefore rural regions which depend on these sectors for employment are more likely to witness outmigration. Also, careers in these sectors may be seen as 'secure' and therefore people employed in these sectors are less likely to be risk takers, which is a necessary trait for investment and business creation.

In terms of people and population the results at the EU level were surprising. Age and education had no impact on structural strength. For our measure in social capital the result was as expected. Crime, which is used as a proxy for trust in the community, has a negative effect on structural strength. Higher rates of crime will make people less likely to invest and create businesses. The cost of crime can be seen as an extra cost to starting a business. As well as other costs, there will be the costs associated with crime, which reduces potential returns on investment and therefore discourages business creation. In this respect social capital is an important factor for increasing structural strength.

Positive trends are visible for some regions, as presented in this chapter with the examples of Westliche Obersteiermark in Austria and Região de Leiria in Portugal. However, the trends are not so visible for some of the weakest rural regions, regardless of their location. Although situated in very different countries, the two structurally weak rural regions that were analysed, Osttirol in Austria and Alentejo Central in Portugal, are both stuck in a circle of decline for the same reasons. Both face the challenges of outmigration and lack of investment. These issues can be tackled by active rural residents, that is, as per Petrick (2013), the mobile population needs to remain in the area and the immobile population needs to invest locally. In game theory, this is considered a coordination problem. If a region is stuck in the circle of decline, this is the less optimal equilibrium position; this is likely because this solution is 'risk dominant' (Harsanyi, Selten 1988). That is to say, participants choose the less optimal strategy if they consider it less risky. This happens when there is considerable uncertainty regarding the strategy that the other player will choose. In our example, this means the immobile will not invest if they feel there is a high probability that the mobile will move and the mobile will leave if they feel there is a high probability that the immobile will not invest in the region.

The case of eastern and south-eastern Austrian rural regions show that the 'vicious circle' of a declining rural region can be broken if a 'window of new opportunities' opens (like the EU enlargement and opening the borders to the neighbouring countries). The situation of Portuguese rural regions seems worse, they cannot expect similar large-scale shifts in their geopolitical and economic position. This means that the role of national and local governance institutions seems crucial in overcoming structural weakness of such rural regions.

5 Rural Regional Resilience

5.1 Introduction

The purpose of this chapter is to address the third research question: What is the economic resilience of rural regions i.e. how have they responded to the crisis of 2008/09? What are the socio-economic characteristics that contribute to resilience? Will resilience to the 2008 financial crisis be a predictor of resilience to the Covid19 crisis?

As explored in the literature review, economic resilience has become a prominent research topic within economic geography since the financial crisis of 2008/09 (Hassink, 2010; Fröhlich and Hassink, 2018). The concept of resilience to the financial crisis has been studied for households (Dominiak and Konecka-Szydłowska, 2014), for individual regions (Masik and Rzyski, 2014), for regions within individual countries (Lapuh, 2018) and for regions across Europe (Giannakis and Bruggeman, 2017) Although different definitions have been used the most common definition of economic resilience, from an economic geography perspective is: "the capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources" (Martin and Sunley, 2015: 13).

In essence economic resilience can be seen as an economy's ability to withstand and react to a crisis. In this respect there are two stages of economic resilience. The first stage is the resistance and the second stage is the recovery. The resistance stage refers to how the economy reacts to the initial shock. The recovery stage refers to how an economy reacts in the aftermath of the shock.

There has been much research conducted on the determinants of economic regional resilience (Dokic et al., 2016; Lapuh, 2018; Cellini and Cuccia, 2019) and specifically on the economic resilience of cities and urban regions (Simmie, 2017; Tan et al., 2017; Martin and Gardiner, 2019). Some of the important factors that have shown to build resilience in different countries include: in Croatia regions which experienced a weaker decline in construction were more resilient (Dokic et al., 2016), in Slovenia being export orientated, densely populated and having a well-educated work force were important for resilience (Lapuh, 2018) and in

Andalusia in Spain agriculture acted as a haven sector from the crisis for rural areas (Sánchez-Zamora et al., 2014).

There is a lack of research focusing exclusively on the economic resilience of rural regions. This chapter hopes to fill the gap in the literature by specifically analysing how resilient rural regions were following the economic crisis of 2008/09 and what are the determinants of rural resilience. This will be done for all rural regions in the EU following the financial crisis of 2008. One main drawback of the literature regarding economic resilience is that it relies on data from the financial crisis of 2008. It is important to note that the determinants of economic resilience to the financial crisis of 2008 may not be determinants of economic resilience for other recessions. Following on from the analysis of EU rural regions' resilience in response to the financial crisis, this chapter will briefly analyse how counties in Ireland were affected by subsequent recessions to understand if there is a correlation between economic resilience to the financial crisis of 2008 and resilience to the Covid19 recession of 2020. It is still early in terms of the Covid19 recession and as time progresses further data will likely become available. For now, there is limited data regarding the Covid19 recession and therefore this section will be limited to analysing how unemployment changed in Irish counties in response to both recessions and how urban and rural counties differed in how they were affected.

Ireland is an interesting case to study for several reasons. It was one of the countries in the EU most negatively affected by the financial crisis and was often grouped alongside Portugal, Italy, Greece and Spain to be given the acronym 'PIIGS'. These were considered the worst affected countries in the EU. However, Ireland experienced a significant recovery from the recession which has been dubbed by some in the media as the 'Celtic Phoenix' (Brady 2014; Reilly 2014). In 2014, the then German finance minister, Wolfgang Schauble, even claimed that Germans were 'jealous' of the economic growth figures that were being achieved by Ireland (O'Hora, Kelpie 2014). This supposed 'miraculous' recovery has not been without its critics, with some claiming that in Ireland it has been a two-tier recovery with the growth being concentrated in Dublin (and some other urban centres), while the rest of the country, especially rural areas, continue to fall further behind (Weston, 2015). This chapter will analyse if there is a correlation for economic resilience of Irish counties for subsequent recessions and if more rural counties were more or less affected by both recessions.

The chapter is divided into a further five sections. Section 5.2 will explain the methodology used throughout the chapter. Section 5.3 will analyse the economic resilience of rural regions across the EU in response to the financial crisis of 2008/09. Section 5.4 will analyse the determinants of economic resilience of EU rural regions to the financial crisis. Section 5.5 will explore the economic resilience of Irish counties for subsequent recessions and if there was an urban-rural divide for either recession. Finally, section 5.6 will summarise the main findings from the chapter.

5.2 Methodology

For measuring economic resilience there are two stages to be considered: the resistance to the initial shock and the recovery from that shock. For that reason, we have two indexes that we use, this is similar to the work of Giannakis and Bruggeman (2020). Both of these indexes will be used in section 5.3 when analysing resilience of EU rural regions. The first index, which will be referred to as the resistance index, measures the reaction of rural regions to the initial shock. This index is:

$$\beta_1 = \frac{\left[\frac{E^R_{2013}-E^R_{2008}}{E^R_{2008}}\right]-\left[\frac{E^{EU}_{2013}-E^{EU}_{2008}}{E^{EU}_{2008}}\right]}{\left|\frac{E^{EU}_{2013}-E^{EU}_{2008}}{E^{EU}_{2008}}\right|} \quad (1)$$

where E^R is the number of people employed in the region, and E^{EU} is the number of people employed in the EU. The year 2008 was selected as the peak year i.e. it was the year with the highest number of people employed in the EU pre-crisis. The year 2013 was selected as the trough year as it was the year with the lowest number of employed people in the EU. This index measures the effect that the drop of employment in the EU (from 2013 to 2008) had on the regional employment of rural regions in the EU. A result of greater than 0 shows that a region is resilient, i.e. employment fell less that proportionally compared with the whole of the EU. A result of less than 0 shows that the region is vulnerable, i.e. employment in the region fell more than proportionally than the EU.

The second index, which will be referred to as the resistance and recovery index, shows the effect of both stages of resilience on regional employment. The index is:

$$\beta_2 = \frac{\left[\frac{E^R_{2015}-E^R_{2008}}{E^R_{2008}}\right]-\left[\frac{E^{EU}_{2015}-E^{EU}_{2008}}{E^{EU}_{2008}}\right]}{\left|\frac{E^{EU}_{2015}-E^{EU}_{2008}}{E^{EU}_{2008}}\right|} \quad (2)$$

This index again uses the year 2008 as the starting point of the recession. This index differs as it uses 2015 as the ending of the recession, this is chosen as it is the first year where there were two consecutive years of employment growth following the recession. This measures the employment change of regions from 2008 to 2015 compared to employment change in the EU. The result are interpreted in the same way as the previous index i.e. a result of greater than 0 is an indication of resilience while a score of less than 0 is an indication of vulnerability. Both of these indexes are calculated for EU rural regions and the results are presented in section 5.3. Following the calculations of these indexes, OLS models were used to analyse the determinants of economic resilience of rural regions. First the OLS regressions are calculated using the results of the first index as the dependent variable and the then the OLS regression are calculated using the results of the second index as the dependent variable. The independent variables used are the same as the two previous chapters, an overview of these independent variables is available in chapter 3, section 3.2. The results of these OLS models is presented in section 5.4.

After completing the analysis on an EU level it is important to analyse the case study of Ireland, which will be provided in section 5.5. Ireland provides a good case study as it is a largely rural country and, as mentioned in the introductory section to this chapter, it was negatively affected by the financial crisis but has since experienced a strong recovery. The analysis for Ireland will examine resilience to both the financial crisis of 2008 and the Covid19 crisis of 2020. The purpose of this is to examine if resilience to the financial crisis is a predictor for resilience to the Covid19 crisis. The index differs to the previous two indexes used due to data constraints. There is no information yet regarding number of employed people for different counties in Ireland, but instead the number of unemployed people is used for the formula. The formula used for this section will be similar to the employment sensitivity index proposed by Martin (2012):

$$\beta_3 = (\Delta UnC/UnC)/(\Delta UnN/UnN); \quad (3)$$

where UnC is unemployment in the county, and UnN is unemployment in the nation. This formula compares the change in number of people unemployed in a county to the change in the number of people unemployed in the whole nation. A result of greater than 1 would indicate that a region is more vulnerable to changes in the national economy, i.e. the number of unemployed increased more than proportionately in the county compared to the nation. While

a score of less than 1 would signify that a region is relatively resilient, that is to say, the number of people unemployed in the county increased by a smaller proportion than the nation's unemployment as a whole. In contrast to Martin (2012), who used a single time period for the peak and trough for all regions, this chapter uses a method similar to Sensier and Artis (2014). In their work, Sensier and Artis (2014) used a more flexible method that allows for different start points and end points for the recession in each region. We consider the start point of the recession to be the month with the lowest unemployment and the end point of the recession is considered to be the month with the highest unemployment.

The data for unemployment in Ireland, which consists of 26 counties (i.e. the six counties of Northern Ireland are not included), comes from Ireland's Central Statistics Office (CSO). When referring to unemployment it is in reference to the number of people on the 'Live Register' and people in receipt of the 'pandemic unemployment payment' (PUP). The 'Live Register' refers to people that are registered for unemployment assistance. The PUP is an additional payment introduced to help people who lost their jobs due to the Covid19 crisis.

The data for 'Population Distribution' comes from the 2016 census, also available from the CSO. It divides the residence of the population into six categories: cities, satellite urban towns, independent urban towns, rural areas with high urban influence, rural areas with moderate urban influence and highly rural/remote areas. A table showing the percentage of people residing in each category for all counties is provided in the appendix (table 7.2). For the purposes of this analysis I will categories counties as 'urban' if they have 60% or more of their population residing in cities, satellite urban towns and independent urban towns. I will categories counties as 'rural' if they have 60% or more of their population residing in rural areas with high urban influence, rural areas with moderate urban influence and highly rural/remote areas. All the remaining counties will be classified as 'intermediate'. Using this method there are 6 urban counties, 8 intermediate counties and 12 rural counties. This is presented in table 5.4, in section 5.5.

To test if population distribution was relevant for resilience to the financial crisis of 2008 or the Covid19 I use the Pearson correlation method. This is a bivariate method and "was the first formal correlation measure, and it is still the most widely used measure of relationship" (Rodgers & Nicewander, 1988, p. 61). It is suitable for quantitative variables and is a "measure of the strength of the linear relationship between two such variables" (Hauke & Kossowski, 2011, p. 88).

5.3 Economic Resilience of Rural Regions in Europe

The first task is to analyse the resilience of rural regions across the EU. In order to do this the two indexes, the 'resistance index' and the 'resistance and recovery index', were calculated for 327 rural regions in 22 EU countries. Out of the 27 EU countries 5 countries are not represented. Three are not represented as they do not have any rural regions (Cyprus, Luxembourg and Malta) and two countries were dropped due to lack of data (France and Poland).

The results of the resistance index are presented geographically in figure 5.1. This index examines the effects of the initial shock, from 2008 to 2013, had on employment in the rural regions of the EU. The resilient regions, those that were able to absorb the shock without significant losses to employment, are clustered in the centre of the map, located primarily in Germany and Austria. No rural region in Austria was vulnerable and only some of the rural regions in the north-easterly part of Germany were vulnerable. The most vulnerable regions are located along the periphery of the EU in countries such as Ireland, Portugal, Spain and Greece. In fact all the rural regions in Ireland, Portugal and Spain experienced drops in employment which was greater than the drop in employment for the EU as a whole.

This is an indication that being located in the centre or core of Europe is beneficial for the economic resilience of rural regions. However, rural regions which are located further from the core, along the periphery of Europe were more likely to be vulnerable to the impact of the financial crisis.

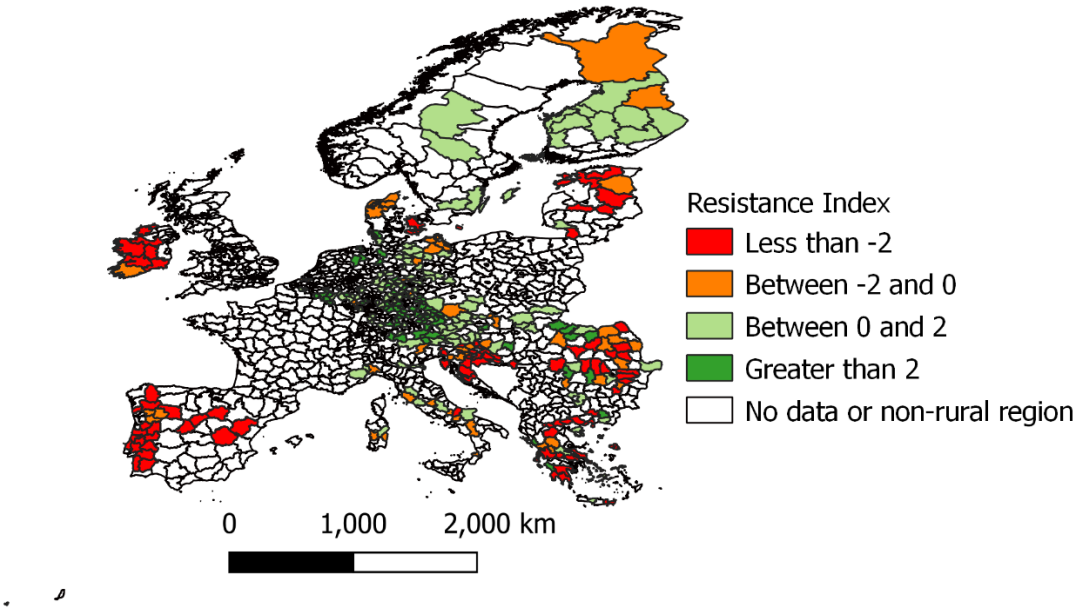

Figure 5.1: Resilience of rural regions in Europe, using resistance index

Source: Own work using data from Eurostat

The results of the resistance and recovery index are presented geographically in figure 5.2. This measures the effect of both the shock and recovery phase on regional employment in comparison to the EU as a whole. This is an indication as to how the rural economies were able to absorb the initial shock and respond to it. The results mirror those of the previous index. All of the rural regions in Austria were resilient and the majority of those in Germany were also resilient, only some of the north-easterly regions in Germany showed some vulnerability. Again employment in all the rural regions in Ireland, Portugal and Spain were vulnerable to the effects of the financial crisis.

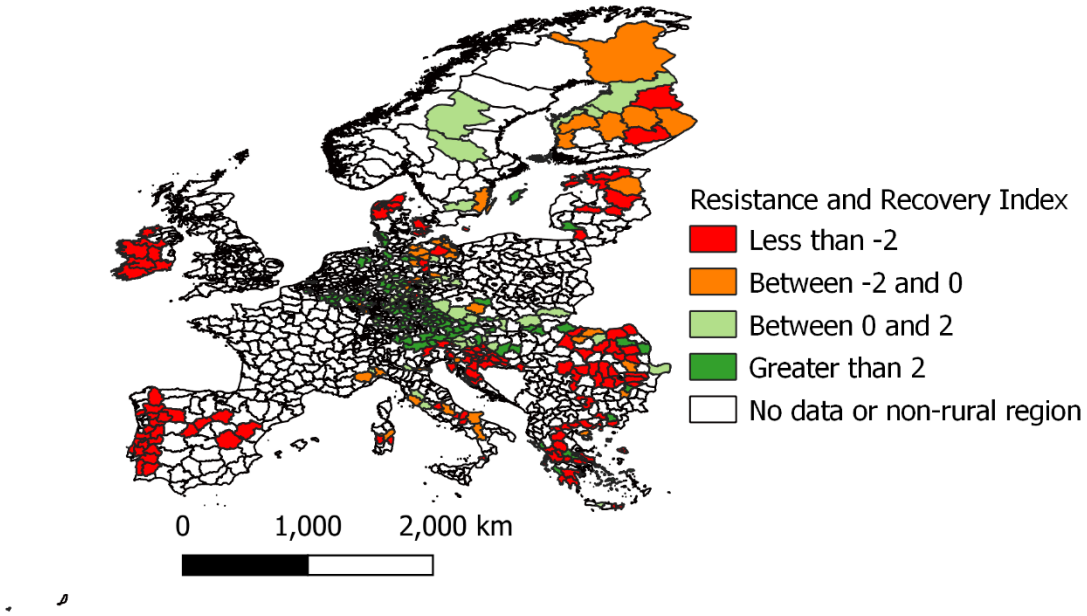

Figure 5.2: Resilience of rural regions in Europe, using resistance and recovery index

Source: Own work using data from Eurostat

A breakdown of the descriptive statistics for the resistance index and the resistance and recovery index are presented in table 5.1. For both indexes it is surprising that there are a greater number of resilient regions compared to vulnerable regions. For the resistance index there are 193 resilient regions and 134 vulnerable regions. For the resistance and recovery index there are 166 resilient regions and 161 vulnerable regions. The number of vulnerable regions for the resistance index is 134 but increases to 161 for the resistance and recovery index which could indicate that the recession spread to rural regions after its effects were first felt in urban regions. This would make sense as the financial crisis initially impacted the banking sector which is predominately located in urban regions. It could also indicate that the recession lasted longer in rural regions than non-rural regions, which may be because rural regions are less adaptive than urban regions. The mean for the resistance index was -0.05 which indicates that on average rural regions were less resilient than the EU. So despite the number of vulnerable rural regions being less than the number of resilient rural regions, the average was a negative figure. The mean for the resistance and recovery index was -0.84 which indicates that the recovery was less felt in rural regions.

The minimum figure for the resistance index was -9.27 and dropped to -20.57 for the resistance and recovery index. The maximum figure increased from 7.17 for the resistance index to 15.72 for the resistance and recovery index. The standard deviation also increased from 2.49 to 5.74. This all indicates an increase in disparities. Some rural regions were less affected and recovered strongly from the financial crisis while others were affected more severely and were slower to recover. These figures indicate a general divergence in the circumstances of rural regions.

Table 5.1: Descriptive statistics of economic resilience of rural regions in the EU

	Resistance index	**Resistance and Recovery index**
Number of vulnerable regions	134	161
Number of resilient regions	193	166
Minimum	-9.27	-20.57
Maximum	7.17	15.72
Mean	-0.05	-0.84
Standard Deviation	2.49	5.74

Source: Own calculations using data from Eurostat

5.4 Determinants of Economic Resilience of Rural Regions

The goal of this section is to understand what were the determinants of economic resilience for rural regions in the EU. This will be done using OLS regression analysis. First this will be done by using the results from the resistance index as the dependent variable and then will be repeated for the resistance and recovery index. The independent variables used are

those that are presented in chapter 3, section 3.2. The first task of this section is to analyse the determinants of the first index: the resistance index. There have been four regression models performed with the resistance index as the dependable variable (models 5.1, 5.2, 5.3 and 5.4). These models are presented in table 5.2. There were 327 observations for each of the models, these are the rural regions for which sufficient data exists to perform these regressions.

Model 5.1 has 14 independent variables, of which five of these variables are statistically significant. Patents has a positive effect on resilience, which is what would be expected i.e. more innovative rural regions were more resilient. Tourism had a positive impact on resilience, this was not the expected result as it was assumed that tourism was a sector which was heavily affected by the crisis, however rural regions which depended more on tourism were actually more resilient. Median age of the population has a negative impact on resilience which is to be expected as it means that rural regions with a younger population were more resilient. Education had a negative impact which is a surprise. Hospital beds, which is used as a proxy for access to services, has a positive effect which is the expected result i.e. more accessible rural regions were more resilient. An interesting result is that the log of GDP per capita in 2008 was not statistically significant i.e. wealthier rural regions were neither more nor less resilient.

Model 5.1 has an issue with multicollinearity i.e. some of the independent variables are highly correlated with each other. For model 5.2 a VIF cut-off of 5 was used so that any variable with a VIF value of higher than 5 was discarded from the model. This means that agriculture was dropped from the model. Model 5.2 had some of the same results as model 5.1: patents, tourism and hospital beds were positive while median age and education were negative. In model 5.2 an extra two independent variables became statistically significant and both had a positive impact on resilience: finance and public admin. This means that rural regions with higher employment in finance and public admin were more likely to be resilient.

Model 5.3 introduces a location variable for Germany. The coefficient for the variable is positive and statistically significant. This means that rural regions in Germany tended to be more resilient than other rural regions. Model 5.4 drops the location variable for Germany and introduces a location variable for Ireland. The coefficient for this variable is negative and statistically significant meaning that rural regions in Ireland were more vulnerable than other rural regions. This shows that national setting is important for determining the resilience of individual rural regions.

Table 5.2: Determinants of economic resilience for rural regions in the EU, using resistance index

	Resistance Index			
Variables	**(5.1)**	**(5.2)**	**(5.3)**	**(5.4)**
Ln (GDP per Capita 2008)	0.3381	0.3225	0.1362	0.4051
Ln (Patents)	0.0557***	0.0557***	0.0481***	0.0539
Tourism	2.5531**	2.4982**	2.7122**	2.2708**
Agriculture	1.4372			
Industry	-1.1601	-0.239	-0.1305	-0.3711
Construction	-3.1553	-4.7545	-6.3496	-3.2903
Retail	-0.7523	-1.9099	-1.4198	-1.8945
Finance	10.5492	9.3937*	11.3017**	9.3206*
Public Admin	6.6088	5.1761**	4.2808*	4.8763**
Median Age	-4.5492***	-4.5534***	-6.5774***	-5.7701***
Education	-0.0458**	-0.0466**	-0.0531**	-0.035
Population Density	0.0998	0.0963	-0.1005	0.1195
Hospital Beds	0.4528***	0.4517***	0.3646***	0.4409***
Crime	0.1055	0.1039	0.1305	0.1157
Germany			1.0386**	
Ireland				-1.7291*
N	327	327	327	327
R^2	0.4603	0.4602	0.4684	0.4658

Source: Own calculations using data from Eurostat (=significant at 90%; **=significant at 95%; ***=significant at 99%)*

The next task of this section is to analyse the determinants of the second index: the resistance and recovery index. Four models were constructed to analyse the determinants of the second index (models 5.5, 5.6, 5.7 and 5.8). These models were also calculated for 327 rural regions in the EU and are presented in table 5.3.

Model 5.5 shows the same statistically significant variables as model 5.1: patents, tourism and hospital beds have a positive impact on resilience, while median age and education have a negative impact on resilience. Due to multicollinearity of model 5.5, model 5.6 uses a VIF cut-off of 5. This means that agriculture, which had a high VIF, was dropped from model 5.6. Model 5.6 has the same statistically significant variables as model 5.5: patents, tourism and hospital beds have a positive impact on resilience, while median age and education have a negative impact on resilience. Model 5.6 however has two extra statistically significant variables, it finds that employment in finance and public admin both had positive impacts on resilience. Model 5.7 introduces a location variable for German regions. This variable is positive and statistically significant which means that rural regions in Germany were more resilient. Model 5.8 introduces a location variable for Ireland. This variable is not statistically significant. The results of the location variables again shows the importance of national setting.

Table 5.3: Determinants of economic resilience for rural regions in the EU, using resistance and recovery index

	Resistance and Recovery Index			
Variables	**(5.5)**	**(5.6)**	**(5.7)**	**(5.8)**
Ln (GDP per Capita 2008)	0.4373	0.5126	-0.042	0.6429
Ln (Patents)	0.1321***	0.132***	0.1093***	0.1292
Tourism	5.1665**	5.4301**	6.0675**	5.0712**
Agriculture	-6.9011			
Industry	-0.6122	6.1059	6.4291	5.8974
Construction	-6.0453	1.6336	-3.1156	3.9444
Retail	-2.4785	3.0801	4.5395	3.1044
Finance	14.1438	19.6923*	25.3736**	19.577*
Public Admin	12.8056	19.6846***	17.0188***	19.2115***
Median Age	-16.1073***	-16.087***	-22.1136***	-18.0075***
Education	-0.0954**	-0.0915*	-0.111**	-0.0732
Population Density	0.3976	0.4144	-0.1715	0.451
Hospital Beds	0.7835***	0.7885***	0.529***	0.7715***
Crime	-0.0528	-0.0453	0.0339	-0.0268
Germany			3.0924***	
Ireland				-2.7289
N	327	327	327	327
R^2	0.4717	0.4711	0.4848	0.4737

Source: Own calculations using data from Eurostat (=significant at 90%; **=significant at 95%; ***=significant at 99%)*

5.5 Economic Resilience in Ireland for Subsequent Recessions

The first goal of this section is to understand if there iss a correlation between economic resilience to the financial crisis of 2008/09 and economic resilience the Covid19 of 2020 crisis. For that reason, the sensitivity index, β_3, described in the methodology section was calculated for all 26 counties in Ireland in response to both recessions. The results are presented in table 5.4. The table also includes the classification of counties as urban, intermediate or rural, according to the criteria explained in the methodology section. Further analysis on the correlation between population distribution and economic resilience will be provided below. For now I am interested in the correlation between economic resilience to the financial crisis and resilience to the Covid19 crisis.

It can be seen from the table that there are examples of some counties which have been resilient to both, Waterford for example has been resilient to both recessions. Meath on the other hand has been vulnerable to both recessions. Some counties, such as Laois, were vulnerable to the financial crisis but resilient to the Covid19 crisis while other counties, such as Galway, were resilient to the financial crisis but vulnerable to the Covid19 crisis. When the Pearson correlation method was used to check if there was a correlation between economic resilience to the financial crisis and economic resilience to the Covid19 crisis, the coefficient was 0.29 with a P-value of 0.15. This means that the result is statistically insignificant, i.e. counties which were resilient to the financial crisis were not necessarily resilient to the Covid19 crisis. This is an important finding as it shows that resilience to the financial crisis is not a good predictor for resilience to the Covid19 crisis.

Table 5.4: Sensitivity Index in relation to Covid19 crisis and financial crisis

County	Classification	Resilience to Financial crisis	Resilience to Covid19 crisis
Carlow	Intermediate	1.3794	0.7158
Cavan	Rural	1.2296	0.9424
Clare	Rural	0.9011	0.9492
Cork	Urban	1.0541	1.2563
Donegal	Rural	0.8531	0.7382
Dublin	Urban	0.9348	1.1671
Galway	Intermediate	0.9266	1.0257
Kerry	Rural	0.9679	0.8980
Kildare	Urban	1.3652	1.0436
Kilkenny	Rural	1.0436	1.0772
Laois	Intermediate	1.7857	0.7114
Leitrim	Rural	1.1852	0.7676
Limerick	Intermediate	1.1074	0.9885
Longford	Rural	0.9058	0.5811
Louth	Urban	0.9183	0.7130
Mayo	Rural	0.9907	0.7848
Meath	Intermediate	1.5363	1.7714
Monaghan	Rural	1.2883	1.0363
Offaly	Intermediate	1.2126	0.7273
Roscommon	Rural	1.2092	1.0418
Sligo	Rural	1.1013	0.8909
Tipperary	Intermediate	1.2212	0.7782
Waterford	Urban	0.7611	0.6167
Westmeath	Intermediate	0.9479	0.7809
Wexford	Rural	1.0196	0.6874
Wicklow	Urban	1.0988	1.0529

Source: Own calculations based on data from the CSO

The geographical distribution of the sensitivity index in relation to the financial crisis is presented in figure 5.3. The vulnerable counties were those that were close in proximity to Dublin, even though Dublin itself was not vulnerable. The resilient counties were those on the west coast of the country. One interesting aspect is the lack of strong resilience for counties during the financial crisis, no county showed strong resilience (a sensitivity score of less than 0.75). The economic resilience of counties to the Covid19 crisis is presented geographically in figure 5.4. It is hard to see any clear geographic pattern in the resilience to the Covid19 crisis. In contrast to the lack of strong resilience of any counties to the financial crisis, there are eight counties that have shown strong resilience to the Covid19 crisis.

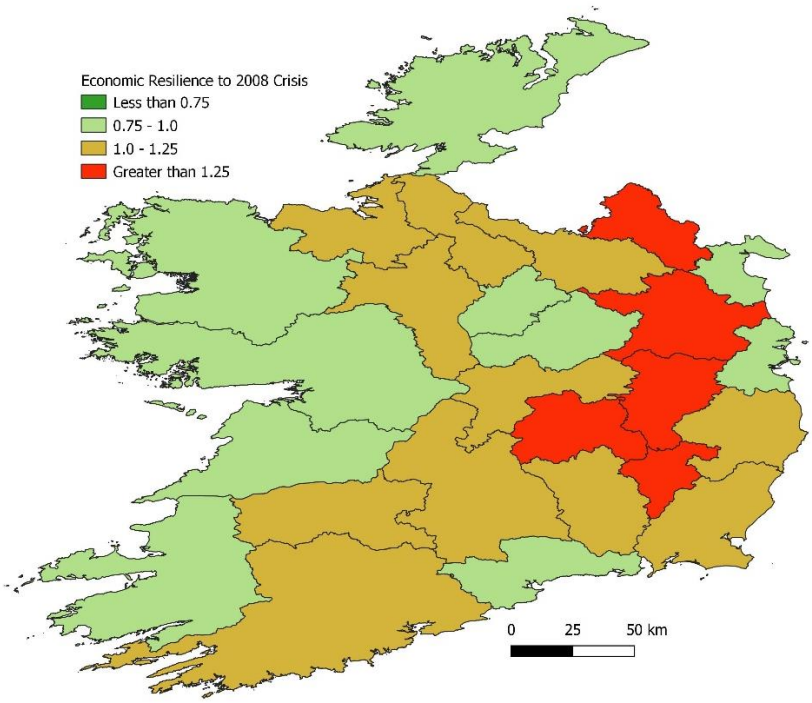

Figure 5.3: Economic resilience to financial crisis of 2008

Source: Own calculations based on data from the CSO

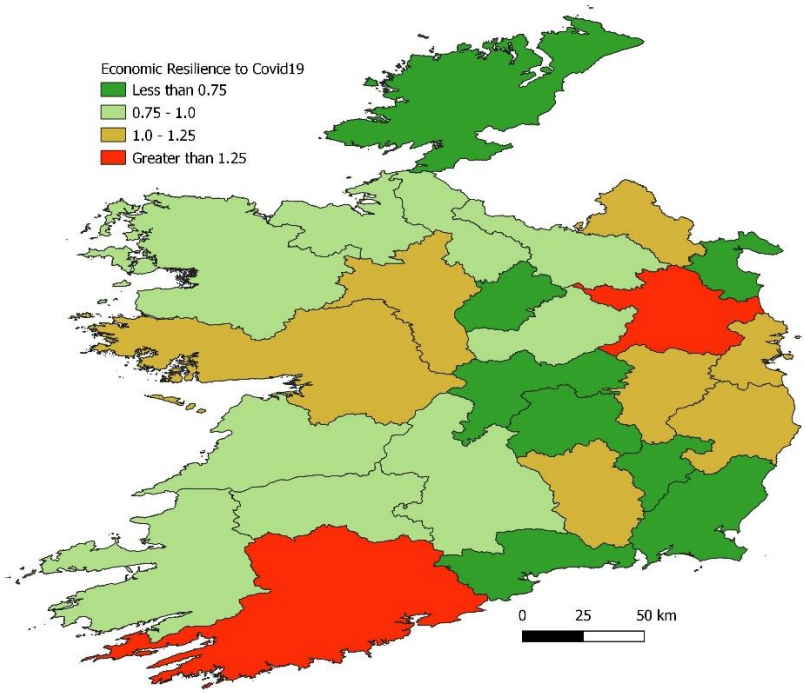

Figure 5.4: Economic resilience to Covid19 crisis

Source: Own Calculations based on data from the CSO

The next challenge is to see if the population distribution of a county had an effect on resilience. The CSO in Ireland classifies the population distribution according to 6 classifications relating to urban/rural. The breakdown of this population distribution for the 26 counties is available in the appendix in table 0.2. The Pearson correlation coefficient was used to first check for a correlation between population distribution and economic resilience to the financial crisis. This was then done for the economic resilience to the Covid19 crisis. The results for the Pearson correlation between population distribution and economic resilience to the financial crisis is presented in table 5.5. As can be seen from the table, none of the variables were statistically significant. That is to say 'population distribution' did not have an effect on the economic resilience of counties with respect to the financial crisis. This indicates that the negative impact of the financial crisis was likely felt throughout the country and all population, urban and rural, were impacted by the recession.

Table 5.5: Impact of population distribution on economic resilience to the financial crisis

Independent Variable	Pearson Coefficient	P-value
Cities	-0.3225	0.1081
Satellite urban towns	0.2421	0.2335
Independent urban towns	0.1283	0.5323
Rural areas with high urban influence	0.2436	0.2304
Rural areas with moderate urban influence	0.0265	0.8979
Highly rural/remote areas	-0.1325	0.5189

Source: Own calculations based on data from the CSO

The correlation between population distribution and economic resilience to the Covid19 crisis is presented in table 5.6. As can be seen, four of the variables had a statistically significant impact on economic resilience. The variables that showed to have a positive effect on resilience (i.e. a negative impact on the sensitivity index) were 'independent urban towns' and 'rural areas with moderate urban influence'. This means that counties with a higher proportion of their population living in areas classified as either 'independent urban towns' or 'rural areas with moderate urban influence' were more resilient. The variables that had a negative impact on resilience (i.e. a positive effect on the sensitivity index) were 'satellite urban towns' and 'rural areas with high urban influence'. That means that counties with a proportionately high population in these areas were more vulnerable to unemployment caused by the Covid19 crisis.

The unemployment caused by the Covid19 recession has largely been in sectors considered 'non-essential'. This is because workplaces which were non-essential were forced to close during the lockdown phases. It is likely that 'independent urban towns' and 'rural areas with moderate urban influence' have larger proportion of people working in essential sectors and that 'satellite urban towns' and 'rural areas with high urban influence' have more people working in non-essential jobs. This could have been the cause for the higher rise in unemployment in 'satellite urban towns' and 'rural areas with high urban influence'.

Table 5.6: Impact of population distribution on economic resilience to the Covid19 crisis

Independent Variable	**Pearson Coefficient**	**P-value**
Cities	0.2327	0.2527
Satellite urban towns	0.5911***	0.0015
Independent urban towns	-0.5328***	0.0051
Rural areas with high urban influence	0.3673*	0.0649
Rural areas with moderate urban influence	-0.4686**	0.0158
Highly rural/remote areas	-0.2762	0.172

Source: Own calculations based on data from the CSO (=significant at 90%; **=significant at 95%; ***=significant at 99%)*

5.6 Summary

The purpose of this chapter was to address the third research question: What is the economic resilience of rural regions i.e. how have they responded to the crisis of 2008/09? What are the socio-economic characteristics that contribute to resilience? Will resilience to the 2008 financial crisis be a predictor of resilience to the Covid19 crisis? The results of the β_1 and β_2 indexes reveal some interesting facts about the economic resilience of rural regions across the EU. The majority of rural regions in the EU were affected less than proportionally by the recession than the EU as a whole. However the regions which were negatively affected were affected more strongly. The recovery was less felt in rural regions than in the EU as a whole. This indicates that rural regions were slower to recover from the recession than other regions. The shock and recovery had an intensifying impact on rural polarisation in the EU.

For determinants of economic resilience for rural regions it was shown that innovative rural regions were more resilient. Access to services was also a contributing factor to resilience. In terms of sectors it was shown that reliance on tourism and employment in public administration were both contributors to economic resilience. Higher median age was shown to have a negative impact on economic resilience, meaning that rural regions with an older population were more affected by the financial crisis. The two locator variables used show that the country which a rural region is located has an impact on resilience. Rural regions in Germany were more resilient, while rural regions in Ireland were more vulnerable to the crisis.

It is important to note that the majority of research done on economic resilience uses the case of the 2008 financial crisis. It should not be assumed that resilience to one recession is a predictor for resilience to subsequent recessions. As was shown here using the example of Irish counties, resilience to the financial crisis was not a predictor of resilience to the Covid19 crisis. As time goes on and more data regarding the Covid19 crisis become available this research should be expanded. It will be interesting to compare the determinants of economic resilience to the 2008 financial crisis to the determinants of the Covid19 crisis.

6 Conclusions and Recommendations

The aim of this research has been to understand the dynamics and spatial polarisation of rural regions, that is to say why some rural regions were thriving while others were stuck in a circle of decline. Despite the common discourse of rural regions being underproductive, lacking job opportunities and experiencing out-migration, more thorough observations reveal that rural regions can be productive, structurally strong, resilient and foster economic growth. The purpose of this chapter is to summarise the main results from the three research questions, following on from the research questions the next step is to address the original research goal which is to examine the dynamics and polarisation of rural regions in Europe. This chapter will further address this research goal and discuss what has been learned regarding the economics of rural regions. This chapter will provide some final thoughts regarding the potential direction of further research and offer some policy recommendations.

The main purpose of the thesis was tackled by addressing the three research questions:

1. What are the regional disparities among rural regions in Europe? What is the trend over time? Can convergence be observed?
2. What is the structural strength of the rural regions and how did it change over time? What socio-economic characteristics influence the structural strength of the rural regions?
3. What is the economic resilience of rural regions i.e. how have they responded to the crisis of 2008/09? What are the socio-economic characteristics that contribute to resilience? Will resilience to the 2008 financial crisis be a predictor of resilience to the Covid19 crisis?

The mainstream economic theories draw strong conclusions regarding regional disparities and convergence however they do not offer a clear resolution to the question which is fundamental for the current study concerning rural polarisation. There is evidence that regional disparities among rural regions is an issue in the EU and within individual countries. On an European scale the economy is an example of a core-periphery economy which is predicted by new economic geography (Krugman, 1991). The core of the economy is located, roughly around Austria and lower Germany. The rural regions located in this core area are strong both in terms of GDP per capita and employment rate. Rural regions which are located in the periphery are weaker and have lower GDP per capita and employment rates. This is true, depending on the measure, for rural regions near the Mediterranean, along the Eastern side of

the EU and in Ireland. The disparities among rural regions were showing signs of falling in the pre-crisis period (before 2008) and since then have increased or stabilised. This is not what would be predicted by the new economic geography, which predicts increasing core-periphery disparities especially during boom years as more production shifts towards urban centres. The idea that disparities would fall during boom years is a conclusion more likely to come from the growth poles literature (Hansen, 1967). According to this theory development centres around growth poles but spreads out from these core areas towards the periphery over time. This is more likely to be the explanation for the decreasing rural disparities during the pre-crisis years (2000-2008). Although, there was higher development levels (in terms of GDP per capita and employment rates) in the rural regions near to the 'core' (Austria and Germany), the economic growth was spreading out towards the more peripheral regions.

Convergence is another important aspect of the mainstream economic theories. When convergence was tested for the rural regions in the EU there were strong signs of convergence for rural regions. This was true at an EU level but was also true at the national level for rural regions in Germany and Greece. This would be a strong argument for the confirmation of the neo-classical growth model. However, it is not as straight forward as it may appear. The convergence was much stronger in the pre-financial crisis period (2000-2008) and has since slowed down considerably. This means that there is not absolute convergence over time, but rather convergence is dependent on other factors including the business cycle. There is a strong cyclical process with respect to both regional disparities and convergence of rural regions. The economy works in a cyclical fashion of boom and bust, the research here finds that levels of convergence are stronger during the boom years and weaker in the bust years. This could be for the same reason that regional disparities were falling during the pre-crisis period. During boom years, growth which originates in the core regions of the economy spreads out towards the more peripheral regions. These peripheral regions, which were disadvantaged then begin to converge with the core regions. During recessionary years this process stops and during the recovery years, the growth is again concentrated in the core regions but will slowly spread to peripheral regions over time. This is as if the growth pole process is repeated after a recession.

When the econometric analysis was expanded to include further independent variables it was shown that some variables had a significant impact on the economic growth of rural regions. The number of patents had a positive impact on economic growth. I use number of patents as a proxy for innovation and this shows that innovation is an important aspect for growth. This is indicative of the endogenous growth models prediction of conditional

convergence, and especially the emphasis on technological progress (Romer, 1990) as innovation is an important factor for achieving technological progress and thus economic growth.

Hospital beds, which are used as a proxy for access to services, show a positive relationship with growth. This finding does suggest that more rural and peripheral regions are likely to suffer slower economic growth. Access to healthcare (Mao et al., 2015) or distance to a hospital (Mountrakis, 2005) are often used in the creation of rurality indexes however this proxy by itself is debatable. Further research should be focused on a smaller level (sub-NUTS 3) and examine this relationship between access to services (along with other measures of rurality) and economic growth. In the econometric model, car thefts were shown to have a negative impact on economic growth. Car thefts here are used as a proxy for social capital, so this result argues that increasing social capital has a beneficial impact on economic growth. The relationship between crime and social capital has been argued in other works (Rosenfeld, Messner and Baumer 2001; Buonanna, Montolio and Vanin 2009). Trust is a central component of social capital. Crime is likely to deteriorate trust in a community, having a negative impact on social capital. Using crime as a proxy for social capital has its limitations but was used because many of the measurements of social capital which are normally used (such as community organisation memberships) are either not available at NUTS 3 level or they are not appropriate for international comparisons. This leaves an opportunity for further research, in the development of an internationally comparable measurement of social capital in rural regions. There is also the opportunity to further research social capital in rural areas and its impact on rural economic growth, possibly at a smaller level (sub-NUTS 3).

The process of rural development is a complex and multi-dimensional issue. To fully understand the process it is important to analyse rural development at a deeper level than GDP per capita. In fact there has been a push lately for economists to move beyond GDP as it is seen as too simplistic a measure for capturing economic strength (Stiglitz, et al., 2018). Using neo-endogenous rural development (Petrick, 2013) as my theoretical framework I have created the SSRR index in an attempt to capture the structural strength of rural regions. This index took into account the complex nature of rural regions by using multiple variables (GDP per capita, employment rate, net business creation and net migration) to capture the multi-dimensional phenomenon of rural development. This index was analysed over time for fourteen EU countries and econometric analysis was performed to analyse the socio-economic characteristics of structurally strong rural regions. This was then repeated at the national level

for two EU countries; Austria and Portugal. Throughout the EU and at a national level it is evident that location is an important determinant of structural strength. At the EU level, structurally strong rural regions are clustered in Austria. This is likely the same reason why rural regions in Austria are generally wealthier, and experience stronger economic growth than rural regions elsewhere in the EU. Rural regions in Austria benefit from the location in the centre of Europe, they are close to the core of the European economy and can benefit from spill-over effects from the core. The rural regions in Austria have also likely benefitted from the expansion of the EU to the east as many of the countries bordering Austria joined the EU in 2004. This opened new trade routes to the East which provided an important opportunity for Austria. In contrast to Austria, rural regions in Croatia are predominantly structurally weak. Croatia is the newest member state of the EU and is relatively poor compared with other member states. It is likely that rural regions in Croatia have yet to benefit from accession, similar to the growth pole theory, it may take some time for the economic benefit to spread to rural regions in Croatia. Even if the benefit of EU membership does spread to Croatia, it is unlikely that rural regions in Croatia will achieve structural strength comparable to rural regions in Austria due to the peripheral location of Croatia. The analysis shows that peripheral EU countries have structurally weaker rural regions.

Location also proves to be an important factor in structural strength when examined at a national level. The importance of location however is different with respects to different countries. In Portugal structurally strong rural regions are regions that are more likely to be located near to the Lisbon-Porto axis. For Austria, the structurally weak rural regions are mountainous regions on the border with Italy. This raises the important concepts of rurality, peripherality and how these concepts are seen and perceived in different countries. In Portugal it is likely that the concepts of rurality and peripherality are associated with distance from the Lisbon-Porto axis and proximity to the Spanish border. However, it is likely that in Austria the concepts of rurality and peripherality are related to the typology of a location. Further research on a national level should try to capture the concepts of rurality and peripherality and how these affect the structural strength of rural regions.

Employment in certain sectors (notably industry and public administration) had negative impact on structural strength. The theoretical framework used for creating the SSRR index uses game theory for explaining how a rural region could remain stuck in the less optimal position, that is why a rural region may remain as structurally weak. As is known from game theory (Harsanyi, Selten 1988), a region is stuck in the less optimal equilibrium position if this

solution is ‘risk dominant’. That is to say, participants choose the less optimal strategy if they consider it less risky. Employment in industry and public administration may be seen as ‘safe careers’ and therefore employment in these sectors will discourage risk taking, especially in terms of business creation. If people have safe careers in industry or public administration they are less likely to start their own businesses. Business creation is an important aspects of building structural strength and therefore careers in these sectors could be detrimental for building structural strength. To fully understand this relationship between risk taking and structural strength, Petrick’s (2013) game theory approach for neo-endogenous rural development should be used to analyse decision making at the micro-level in rural regions. This would be an intensive undertaking but likely to be a fruitful line of research for the future.

Since the financial crisis of 2008/09 there has been an abundance of research regarding regional economic resilience. However, there has been a lack of research regarding the economic resilience of rural regions, despite there being some evidence of rural regions being more negatively affected. This research aimed to fill the gap by analysing the economic resilience of rural regions and the determinants of economic resilience for rural regions. Finally, with the ongoing Covid19 pandemic and following recession it is important to understand if there is a similarity between economic resilience to the financial crisis of 2008 and to the current crisis resulting from the Covid19 pandemic.

The research shows that although a high proportion of rural regions were resilient in terms of absorbing the shock, however the recovery did not spread to the rural regions which were most affected. The financial crisis has had a deteriorating impact on rural regions in the EU. This reemphasises the point made earlier in the chapter regarding the growth pole theory following a recession. It is likely that the recovery starts in the core regions of the economy and slowly spreads out to the more peripheral regions, in essence the recovery acts in a similar way to a growth pole. The number of hospital beds, which is used as a proxy for access to services proves to be an important determinant for resilience. This reinforces the growth pole theory as more accessible regions recovered quicker than less accessible regions.

Innovation was also an important determinant for resilience. This reinforces the finding earlier that innovation is important for economic growth. In terms of economic growth innovation can be linked to the endogenous growth theory (Romer, 1990). However, in response to an economic crisis innovation can be seen as an element of ‘creative destruction’ (Schumpeter, 2003 [1942]). Regions which are more innovative are more easily able to adapt

in response to economic crisis, meaning they can absorb the shock and return to growth quicker than less innovative rural regions which may be slower and more reliant on outside help in response to the crisis.

With the ongoing recession caused by the Covid19 pandemic, the concept of resilience will continue to be of importance in regional studies and economic geography. There is an abundance of literature with respect to resilience following the financial crisis of 2008. However, there is a limit to what can be learnt from the research of a single recession. This research has shown that economic resilience to the financial crisis of 2008 should not be seen as a potential indicator for resilience to the Covid19 crisis. Regions which were resilient to the financial crisis will not necessarily be resilient to the Covid19 crisis. This does however provide a valuable opportunity for further empirical research to be undertaken regarding the determinants of economic resilience. As time progresses and more data is made available, research should focus on comparing the determinants of economic resilience to both recessions.

Evidently an important characteristic of rural polarisation across the EU has been the national setting of rural regions. Throughout this thesis there has been clear indication that the country in which a rural region is located is instrumental in terms of the success of that rural region. So although the EU has done much in an attempt to equalise the living standards across Europe (e.g. through the cohesion policy and structural funds) there remains to be disparities between countries. There are a number of potential reasons for this such as location, culture, institutions, and history. I have said much about the location of countries being beneficial for rural regions. That location in the centre, near the 'core' of the economy, is important as these rural regions benefit more directly from spill-over effects. However, this is not the only possible explanation. The idea that culture could influence economic development was popularised by Max Weber (1992 [1930]) and could arguably be used as an argument for the cause of the polarisation of rural regions in the EU. There have been empirical studies that suggest culture leads to more productive societies (Clark, 1987). To follow this argument, it would suggest that rural regions in the centre of Europe, such as Austrian rural regions, are thriving because their culture promotes more productive use of resources when compared to rural regions in countries such as Portugal or Croatia. Data regarding cultures is difficult to gather and is generally subjective and unreliable, and for that reason this thesis has not incorporated this argument. The difference in the situation of rural regions across countries could also be caused by national institutions as perhaps institutions in these countries are more efficient. The strength of institutions has been studied empirically at a national level (Olson,

1996). It has also been studied at a regional level (Rodríguez-Pose, 2013) because institutions can vary within nations as well. However, at a regional level this research is done at NUTS 2 level. This line of reasoning couldn't be tested in this thesis as the data for institutional strength doesn't exist at a NUTS 3 level. Historical factors have been shown to be influential in determining the current development path of regions (Churski, et al., 2020). It is likely that historical factors, especially around establishing or removing borders, have had a lasting impact (e.g. Ireland-Northern Ireland border, border between East and West Germany). Quantitative data regarding these historical issues is not readily available and so this theory was not tested in this thesis.

The 'value-added' of this thesis to the field of regional studies is the focus on rural areas, and rural development, from a strictly economics point of view. Rural development is a topic which is primarily populated by sociologists but has not been fully addressed by economists. This thesis used the mainstream economic theories and techniques and applied them exclusively to rural regions, by excluding urban and intermediate regions. This has been able to shine a light on topics that have not previously been tackled by economists. The main task of this thesis has been to examine the dynamics of rural regions and rural polarisation. Neo-classical economic theory, when applied to rural regions, would suggest that regional disparities among rural regions should not be an issue in the long-run as all regions will converge. The empirical work in this thesis has shown that the situation is not that straight-forward. The data regarding rural regions in the EU and in individual countries indicate that there is a core-periphery element to the economic dynamics of rural regions. From the economic theory, the growth poles theory has shown to be the most accurate for predicting the economics of rural regions. Growth is centred near the core of the economy and slowly spreads out from the core to the peripheries. This is a slow process and is neither even nor stable. It is not even in the sense that the growth does not spread evenly to all peripheral, rural regions. It is not stable, as we have seen this process can be disrupted by outside shocks such as the financial crisis of 2008. The recovery process has itself replicated a growth pole, with the recovery being centred in rural regions near the core and spreading out to peripheral rural regions slowly.

Throughout this chapter I have mentioned a number of interesting research opportunities that could build on this thesis. To summarise, the following is a list of the recommendations for further research:

1. Rurality is a complex concept which incorporates much more than population density. Access to services is also an integral part of rurality. Further research regarding measurements of accessibility which allow for international comparisons should be done.
2. The quantitative analysis within this thesis should be built upon from postpositivist position which incorporates the qualitative study of rurality. Research on how the concepts of rurality and peripherality differ across countries and how these differing concepts in turn affect the development of rural regions.
3. Crime, in this thesis, was used as a proxy for social capital and was shown to be important for the development of rural regions. However, this measure is overly simplistic. Further research should be done on how to measure social capital in rural regions and how social capital impacts rural development.
4. Petrick's (2013) game theory approach to rural development is innovative and should be used on a microscale in rural areas to study decision making by rural residents.
5. As more data becomes available, compare the response of rural regions to the financial crisis of 2008 and the recession caused by the Covid19 pandemic.
6. Further research should be done on how national setting impacts the development of rural regions, especially in terms of institutions, culture and history.

This thesis has been influenced by stakeholders, mostly social entrepreneurs, in rural regions across Europe and is therefore practically orientated. So, although the purpose of the thesis is not policy orientated, there ae some practical lessons that can be learnt for policy-makers. This is a list of recommendations for policy makers:

1. Rural regions in the EU face unique challenges and there is no silver bullet. Place specific policies are key.
2. Engage with local communities. Communities within rural regions understand the challenges they face and have better knowledge regarding local resources.
3. Promote innovation. Innovation has been shown to influence economic growth, improve structural strength and build resilience of rural regions.
4. Create a risk taking environment. Business creation is important for the development of rural regions. For local residents to start their own businesses requires taking a large risk. Risk taking behaviour should be encouraged.

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Appendix

Table 7.1: Sector classifications

Name in Thesis	NACE Rev.2 classification	Meaning
Agriculture	A	Agriculture, forestry and fishing
Industry	B-E	Industry (except construction)
Construction	C	Manufacturing
Retail	G-J	Wholesale and retail trade; transport; accommodation and food service activities; information and communication
Finance	K-N	Financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities
Public Admin	O-U	Public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies

Table 7.2: Population distribution for Ireland and each county (percentage)

	Cities	Satellite urban towns	Independent urban towns	Rural areas with high urban influence	Rural areas with moderate urban influence	Highly rural/ remote areas	Total
State	33	13	16	16	13	9	100
Carlow	0	0	49	19	26	5	100
Cavan	0	0	31	9	27	33	100
Clare	4	2	33	25	16	20	100
Cork	38	19	6	24	8	5	100
Donegal	0	0	28	9	22	41	100
Dublin	87	11	0	2	0	0	100
Galway	29	11	4	34	12	10	100
Kerry	0	0	34	11	27	27	100
Kildare	0	56	12	28	4	0	100
Kilkenny	5	0	33	29	26	7	100
Laois	0	0	48	24	21	7	100
Leitrim	0	0	10	1	20	69	100
Limerick	45	3	5	29	13	4	100
Longford	0	0	34	4	38	24	100
Louth	0	0	67	20	11	2	100
Mayo	0	0	29	7	26	37	100
Meath	0	49	10	32	7	2	100
Monaghan	0	0	30	7	43	21	100
Offaly	0	0	43	24	25	8	100
Roscommon	0	0	27	15	31	27	100
Sligo	0	0	39	11	29	21	100
Tipperary	0	3	39	19	30	9	100
Waterford	41	12	8	16	18	5	100
Westmeath	0	3	46	25	21	5	100
Wexford	0	0	39	17	31	13	100
Wicklow	0	55	10	26	7	2	100

Source: Own calculations using data from the CSO

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Research Activity

Peer-reviewed Journal Articles

Chatzichristos G. & Hennebry B. (2021) Social innovation in rural governance: A comparative case study across the marginalised rural EU. *Journal of Rural Studies (in press)*

Hennebry, B. (2020) The economic resilience of Irish counties for subsequent recessions and the impact of population distribution on resilience. *R-economy, 6(3)*

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Other Publications

Chatzichristos, G., Hennebry, B. and Stoustrup, S. W. (2020) Challenges and dynamics of structurally weak rural regions. In: *The RurAction Network: Social Enterprises in Structurally Weak Rural Regions: Innovative Troubleshooters in Action. Handbook for Practitioners*, Research Report for the IRS Dialog. Leibniz Institute for Research on Society an Space (IRS), Germany, November

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