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"Did the European Regional Development Fund and Cohesion Fund have a positive impact on the development of renewable energy during the funding period of 2007-2013? An assessment of the impact of Cohesion Policy on climate change mitigation"

By

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Bachelors of Politics and International Relations

"Did the European Regional Development Fund and Cohesion Fund have a positive impact on the development of renewable energy during the funding period of 2007-2013? An assessment of the impact of Cohesion Policy on climate change mitigation"

A Final Year Project Presented

By

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To

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Abstract

Using multivariate regression analysis, this dissertation examines if the ERDF and Cohesion Fund investments in renewable energies had a positive effect during the 2007-2013 funding period. In other words did it result in an increase in the use of RES. Using these findings provides a means of assessing if Cohesion Policy is indeed supporting efforts to mitigate climate change. A comprehensive overview of Cohesion Policy, the ERDF and Cohesion Fund during the funding period 2007-2013 and the issue of climate change reveals a clear rationale that Cohesion Policy is well placed to address climate change through the development of RES. From 2007 to 2013, this support was delivered through investments from the ERDF and Cohesion Fund. Drawing on economic and public policy theories, a theoretical framework is created that suggests Cohesion Policy will have a positive impact, due to its supra-nationally centralized funds, its involvement of sub-national actors and its sensitivity to geography and its operation at the regional level. The findings of this dissertation are that the ERDF and Cohesion Fund had a significant positive impact on the development of RES in 25 European countries in terms of primary production of energy and caused a significant decrease in GHG emissions in the energy sector. However, no such positive impact was found in gross final energy consumption, given difficulties of scale, complexity and isolating causality these findings should not be considered conclusive – however, they do strongly suggest that Cohesion Policy is addressing climate change mitigation and that the ERDF and Cohesion Fund had a positive impact on the development of RES from 2007-2013.

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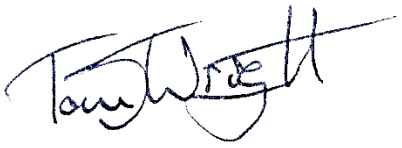
I would like to thank the kind people of Malta EU Steering Action Committee. I want to express my gratitude for providing me with a thoroughly enlightening internship that nourished my interest in the European Union.

Finally, I would like to dedicate this dissertation to my partner for all her love and mental support throughout the development of this project.

Declaration

I, Tom J. Wright, hereby declare that this final year project is entirely my own work. No part of it has been created or written by other persons. All sources and references are fully acknowledged through in text citation and fully referenced in my bibliography pursuant to the standards set forth by the University of Limerick and the Harvard Referencing system. No part of this work has been submitted in pursuit of any other goal, grade or credit.

Signed: 

Date: 5th of March 2018

List of Abbreviations

EAFRD: European Agricultural Fund for Rural Development

EAGGF: European Agricultural Guidance Guarantee Fund

EMFF: European Maritime and Fisheries Fund

ERDF: European Rural Development Fund

ESF: European Social Fund

ESIF: European Structural Investment Funds

EU: European Union

GDP: Gross Domestic Product

GHG: Green House Gas

MFF: Multi-Financial Framework

MLG: Multi-Level Governance

MS: Member States

PPP: Purchasing Power Parity

RES: Renewable Energy Sources

Introduction – Chapter 1

The aim of this dissertation is to examine if the European Regional Development Fund (ERDF) and Cohesion Fund had a positive impact on the growth of renewable energies during the Cohesion Policy funding period 2007-2013. In order to do so, a quantitative study in undertaken to discover if the investment by the ERDF and Cohesion Fund had a significant positive impact on the use of renewable energy throughout the European Union (EU). In total 25 countries are examined. Three countries received no funds during this funding period for renewable energy development. Therefore they were excluded from the study. Using growth in renewable energies and the development of Renewable Energy Sources (RES) this dissertation will also try to examine if the European Union has made progress in its attempt to address climate change (European Commission 2010, Delbeke and Vis 2016, IPCC 2014).

Why does this matter? From global perspective the rationale for such a study is clear – the themes addressed in this dissertation represent some of the most profound and threatening issues of our age. Climate change is threatening human civilization as we know it, entire species are at risk and even whole eco-systems may collapse or change beyond recognition (IPCC 2014). Investment in renewable energy is seen as one way amongst many to adapt and mitigate the effects of climate change since its primary purpose is the reduction of anthropogenic Green House Gases (GHG) emissions (European Commission 2010, Owusu and Asumada-Sarkodie 2016). Thus it is important to investigate did this actually occur? Within the EU, support to mitigate climate change through the development of RES is delivered through Cohesion Policy. Given its scale and importance it is a worthy endeavor to investigate if it had a positive impact on the development of RES during the last funding period: 2007-2013. Finally, the impacts of Cohesion Policy are heavily disputed, investigating its impact in terms of RES and by extension climate change is therefore useful from both an academic and policy practice perspective.

Given the numerous elements involved in this dissertation – Cohesion Policy, structural funds (ERDF and Cohesion Fund), RES and climate change – chapter 2 will provide a thematic overview of the various elements and examine how they are linked together. To begin with this chapter will

present an overview of Cohesion Policy, it will then focus on the 2007-2013 funding period and pay particular attention to the ERDF and Cohesion Fund. Finally, this chapter will explore the link to climate change and present a rationale for why Cohesion Policy through the structural funds is being deployed by the EU to address climate change.

Chapter 3, presents a comprehensive literature review of the theoretical positions suggesting that Cohesion Policy should work and how its impact is understood. The literature review covers numerous different theories and draws on economic regional growth theories as well as theories from public policy such as Fiscal Federalism and Multi-Level Governance (MLG). In terms of structure, this chapter begins by examining the main schools of thought: Convergence, Divergence and Simultaneous Convergence and Divergence. Building on this examination, 4 particularly relevant theories are examined. These are; Endogenous Growth Theory, New Economic Geography, Fiscal Federalism and MLG. One of the main difficulties regarding the literature is placing RES into the theoretical positions. To a large extent these theories examine Cohesion Policy at a different or higher level in comparison with this dissertation. Nonetheless, they do offer theoretical positions that suggest Cohesion Policy is a good policy through which to develop RES at the regional level.

Chapter 4, focuses on data and methodology. In this chapter the different variables will be introduced and the method of the analysis discussed. It will state the hypothesis and it will also discuss the potential difficulties that this quantitative study faces.

Chapter 5, will present the statistical findings. It will present a visual overview of the data, building upon this it will briefly examine it in terms of descriptive statistics. In its penultimate section correlations between the different variables will be discussed and visually presented. Finally, this chapter will present the results from the multivariate regression analysis and discuss any statistically significant findings. Multivariate regression analysis will form the bulk of this chapter.

Chapter 6 is a discussion and conclusion. It synthesizes and discusses the main findings of the quantitative analysis in conjunction with the theoretical ideas introduced in Chapter 3. The aim in this chapter is to discuss the statistical findings in the light of the substantive issues at stake.

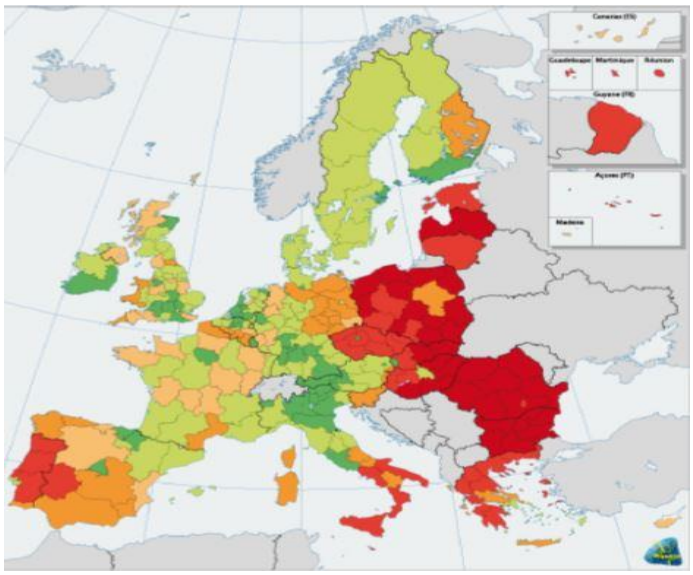
Having outlined the rationale and structure of this dissertation it is now worth briefly commenting on what this dissertation hopes to achieve. Cohesion Policy and climate change are undoubtedly complex, dynamic and leviathan issues. There is therefore little hope of offering concrete and conclusive results. However, it is hoped that this dissertation will at the very least offer some insight into the effects of Cohesion Policy on the relatively niche issue of RES growth in Europe's regions. In doing so it is hoped that it will be able to make an inference with regards to the progress the EU has made to address and mitigate climate change. Therefore it is hoped that this dissertation will make a modest, but brave attempt to contribute towards a better understanding of Cohesion Policy, regional development in terms of renewable energy and climate change. Given the magnitude and importance of any one of these issues, this dissertation is clearly a worthwhile and relevant endeavor. In general terms, it is hoped this dissertation will be able to comment modestly on the state of Cohesion Policy and EU efforts to mitigate climate change from the perspective of renewable energy.

Thematic Overview – Chapter 2

In the introduction a host of different themes, issues and topics were introduced. The aim of this chapter is to act as a descriptive primer for the remainder of this dissertation. Cohesion Policy is a vast and complex policy. Thus the first step is to clarify what it is, how it developed and what its aims are. Additionally, climate change, GHG and renewable energy are all interrelated, dynamic and complex topics. As such they too need to be clarified and qualified with an eye to illustrating their connections and the characteristics relevant to this dissertation. Hence this chapter sets out to present a descriptive and conceptually clear account of the aforementioned topics.

The EU plays a major role in a significant number of policy areas once the sole reserve of states – one such area is that of resource redistribution. This is in a basic sense the bedrock of Cohesion Policy and its fundamental character revolves around addressing inequality and promoting growth at the level of the region (McCormick 2011, p172-176). In fact it is the EU's only dedicated supply-side redistributive policy (Allen 2010, p230). Figure 2.1, presents Europe's regions in terms of GDP per head in 2004. From the figure below it is obvious that there are considerable regional disparities.

Figure 2.1



(Source European Commission 2007, p8)

The development and history of an EU redistributive policy – as embodied in the form of funds can be traced back as early as the Treaty of Rome. The European Social Fund (ESF) had existed since 1958, the European Agricultural Guidance Guarantee Fund (EAGGF) since 1962 and the ERDF since 1975. However, in its early stages funding and indeed what would become Cohesion Policy consisted of little more than national refinancing for pre-selected projects with little European or subnational influence (DG Regio 2008, p8). Prior to 1989, regional policy was considered as a relatively minor policy area designed to support Member States' (MS) regional development projects (Leonardi 2006, p156). During the late 1980s a number of changes occurred that would create Cohesion Policy into what it is today. First, in 1988 the first multiannual financial perspective was agreed. Second, additional funding of 64 billion euro was allocated to the structural funds. Thirdly, on June 24 1988, the Council agreed upon the first regulation to bring the 3 funds existing at that time under one policy umbrella - Cohesion Policy (DG Regio 2008, p8-9). These changes were driven principally by two factors: enlargement which widened regional disparities and the desire to complete the single market (DG Regio 2008, p8). Thus it was really from 1989 that the true character and evolution of Cohesion Policy began.

Cohesion Policy is typically implemented through a clearly defined funding period which operates in tandem with and is dependent on the multiannual financial framework (MFF). There have been 4 funding periods, with the 5th period still ongoing. These are:

- 1989-1993
- 1994-1999
- 2000-2006
- 2007-2013
- 2014-2020

The principle implementation mechanism of Cohesion Policy is through a number of funds. In its current state, it is divided into 5 European Structural and Investment Funds (ESIF). These are designed to tackle a variety of different issues and objectives:

- European Regional Development Fund (ERDF)
- European Social Fund (ESF)
- European Agricultural Fund for Rural Development (EAFRD)
- European Maritime and Fisheries Fund (EMFF)
- Cohesion Fund

Over time Cohesion Policy has evolved since its first inception in 1989 (Leonardi 2006, Begg 2010, p77). While all the changes are too numerous to describe here, it can be examined in terms of what Cohesion Policy actually seeks to address. In the next section the policy aims of Cohesion Policy are addressed. This will set the context for a deeper description of the two funds - ERDF and Cohesion Fund - that form part of the centerpiece of this dissertation.

While initially Cohesion Policy sought to address regional economic disparities through the promotion of growth, it character has evolved to include social challenges as well (McCormick 2011, p172). Additionally, in recent years climate change and sustainable development have also become an important part of the agenda. In fact, since the Treaty of Amsterdam sustainable development has the status of guiding principle in EU policies (Baker 2007, p304). Over time the aim to remove regional economic disparities developed into a policy of cohesion. Cohesion meaning the bringing of all regions of Europe onto a more equal basis (Nugent 2010 p230). The aforementioned driving factor - enlargement - was the principle reason for this expansion in focus and qualitative concern for the quality of life of EU citizens (McCormick 2011, p172-176; Hix and Høyland 2011, p230). As more states joined, the disparities and inequalities became more glaring, visible and pressing (Hix and Høyland 2011, p230). Therefore given these massive disparities the creation, growth and influence of Cohesion Policy is understandable. However, it is also controversial as result of the scale and severity of the problems (Molle 2007, p3). Additionally, the European Commission used its own initiative to develop Cohesion Policy further by including Multi-Level Governance (MLG) as a principle (Allen 2010, p230). This has allowed Cohesion Policy to develop a unique character and address a vast variety of social and economic issues, since MLG has allowed for the inclusion of sub-national and private actors. As Leonardi notes (2006, p165)

Cohesion Policy has taken on a political element in the sense that it attempts to build a mutual solidarity across the regions of Europe.

Thus far, the evolution and general nature of Cohesion Policy has been discussed, in this section the discussion will go a little deeper and examine the ERDF and the Cohesion Fund during the funding period 2007-2013. The aim here is to establish the connection between the wider themes of this dissertation - renewable energy, climate change and the ESIFs.

The funding period 2007-2013 saw reforms of Cohesion Policy, in general it saw the simplification of regulations, procedures and the policy's principal implementation instruments - the funds. There was also a radical shift in priority towards growth and job creation. As a result of the simplified procedures, funding became earmarked for agreed priorities. For example, 30% of funding was earmarked for environmental infrastructure and measures to combat climate change (DG Regio, 2008, p22; European Commission 2007, pp 127-128). The earmarked funds, were specified under 3 objectives and implemented through the ERDF and Cohesion Fund.

The 3 objectives were defined by Council Regulation (EC) 1083/2006 (hereafter referred to the Common Provision Regulation), these objectives were:

1. Convergence
2. Regional Competiveness and Employment
3. European Territorial Cooperation

Convergence was aimed at the least developed regions with the goal of speeding up their development and dramatically increase economic growth. Regional Competitiveness and Employment was designed to address issues outside the least developed regions and European Territorial Cooperation is designed to facilitate cross-border cooperation (Official Journal of the European Union 2006a, p37). Under the Convergence and Regional Competitiveness and Employment objective, a key priority of the ERDF and Cohesion Fund was to contribute to the improvement of the environment, energy efficiency and investment in sustainable development through - amongst other things - the growth of renewable energies (Official Journal of the European Union 2006a, Official Journal of the European Union 2006b and European Commission 2010). These priorities were further defined in two regulations detailing the ERDF and Cohesion

Fund (Official Journal of the European Union 2006c and European Journal of the European Union 2006d). Roughly, these priorities can be condensed into 3 different branches, environment, energy efficiency and investment in RES. This dissertation focuses on the RES branch, therefore the discussion will be limited to RES. The others were mentioned for the sake of a clear overview, context and clarity.

The RES priority under all three objectives, were then turned into workable projects by each MS in their Operational Programmes. For example, in Cyprus, 5 million euro was invested through the Cohesion Fund as part of the Operational Programme: 'sustainable development and competitiveness'. The project involved the placement of photovoltaic cells (solar panels) on public buildings, schools and military camps (European Commission 2013, p2). However, the example illustrates only one type of RES - photovoltaic or solar energy, which is in fact one of four categories of renewable energy recognized as an indicator under the priority of RES. The 4 categories are;

- Wind
- Solar
- Biomass
- Hydroelectric, geothermal and other

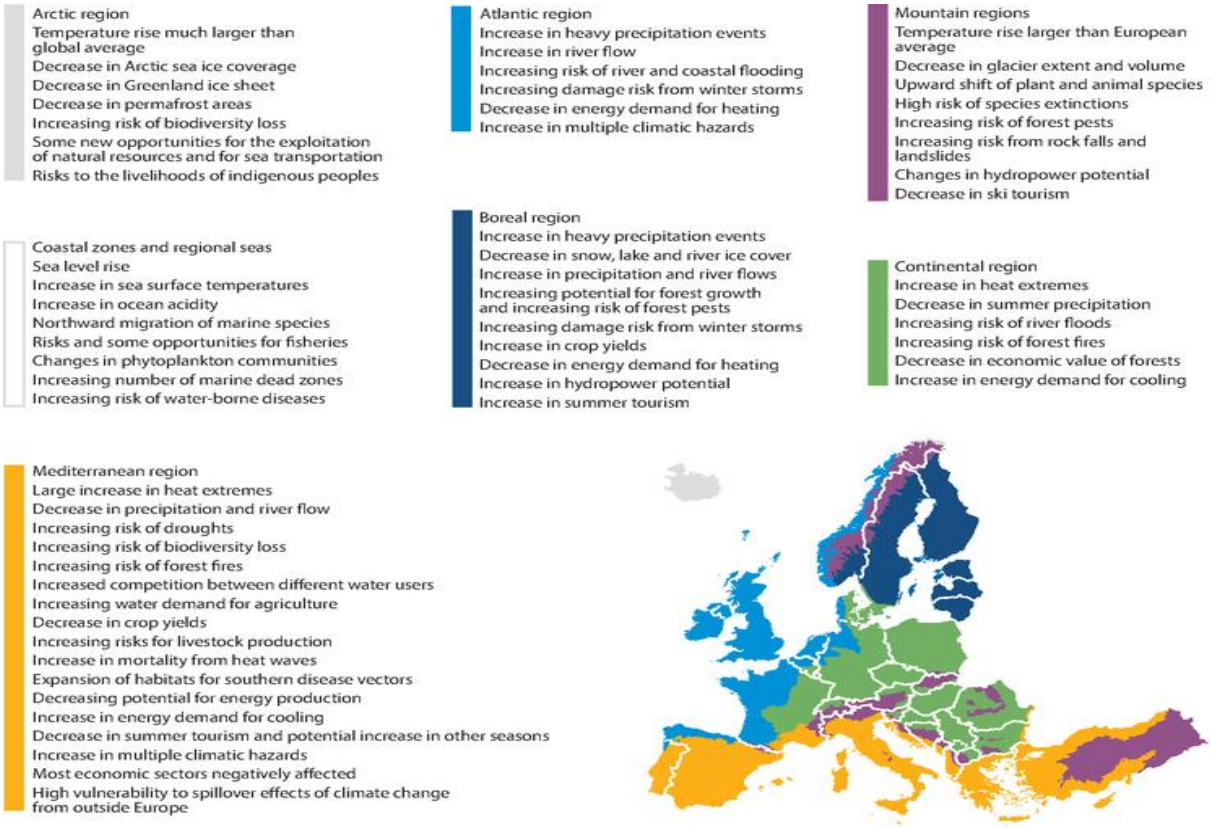
Another example is the use of a biomass based steam system used to generate electricity which was financed through the ERDF in Hungary (European Commission 2013). Similarly, in Austria, a number of projects were supported to develop the generating capacity of 55 plants using biofuels (DG Regio 2014, p77).

This concludes the overview of Cohesion Policy and the discussion of the ERDF and Cohesion Fund. Cohesion Policy is a large and complex policy, its aim is to redistribute resources in order to alleviate disparities and bring about cohesion. Recently, climate change has also become an objective. It was shown that during the 2007-2013 funding period the ERDF and Cohesion Fund supported projects that developed RES. As the previous section showed, the EU has committed substantial resources through Cohesion Policy. It is worth briefly examining the commitments the EU has made with respect to climate change this will help to explain why Cohesion Policy is being used.

The EU is committed to reaching a 20% renewable energy share by 2020, this is in itself one reason for funding projects that develop RES (European Commission 2010). EU commitment to climate change has existed at least since the 1990s, with efforts being made in order to integrate them into the other policy areas such as Cohesion Policy (Skovgaard 2014, p3; Baker 2007, p304, and Wilkinson 1997, p154). This includes the inclusion of the Lisbon Strategy and the 2020 Goals (European Commission 2016, p7). The integration of these different goals is largely referred to as the mainstreaming of climate change into other EU policy areas (Delbeke and Vis, p91). Thus, the EU is clearly committed to addressing climate change and has made considerable commitments to this end. The question now arises what the rationale behind integrating climate change adaption and mitigation into Cohesion Policy?

The rationale behind the integration of climate change as a goal into Cohesion Policy, in other words, the use of Cohesion Policy to mitigate and adapt to climate change becomes clearer when one examines the nature of climate change. First, climate change threatens a number of different areas; economic, social and environmental, additionally it may compound problems already existing in these areas (IPCC 2014 13-15). From an economic perspective, it will damage the ability of regions to grow and interfere with economic activity as regions are adversely affected due to environmental changes such as flooding, storms and fire. It is also predicted to undermine territorial cohesion by exacerbating vulnerabilities (European Environmental Agency 2012). Economic and social development are the main focus of Cohesion Policy. It is aimed at removing disparities and supporting cohesion. Climate change will undermine this agenda. Thus it makes sense that Cohesion Policy, supports economic and social development at the regional level in a manner that supports regions to combat climate change. To do otherwise, would be self-defeating given the threat that climate change poses to socio-economic development.

Figure 2.2

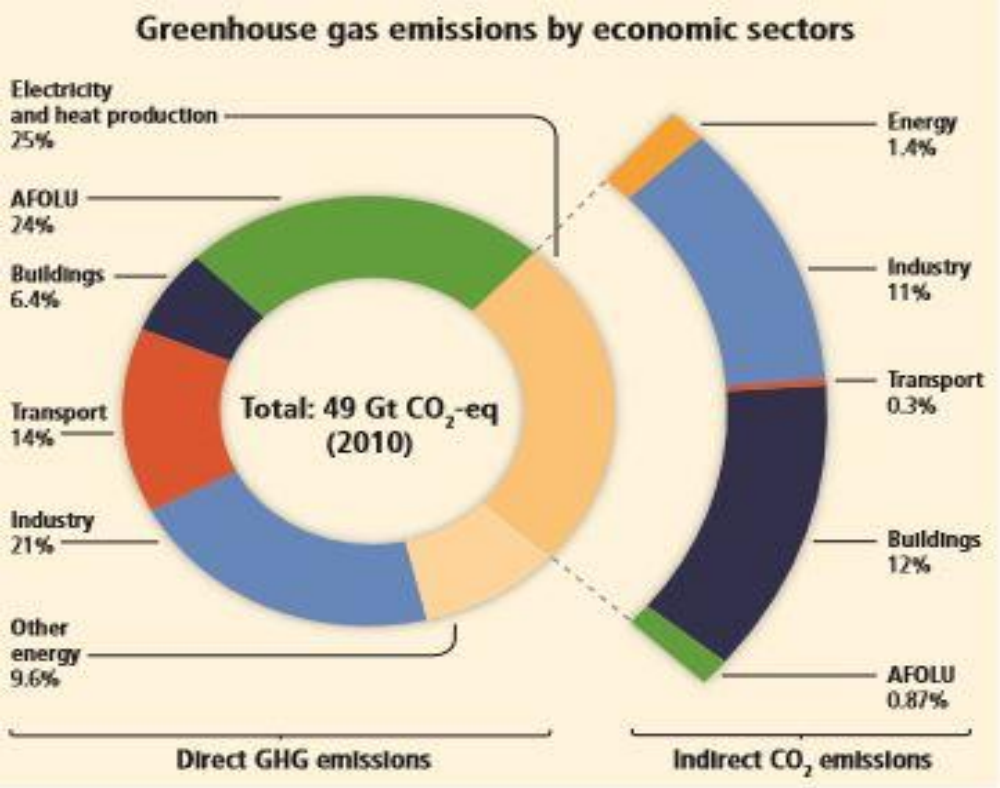


(Source: European Environment Agency 2017)

Second as Figure 2.2 illustrates, different regions will be impacted in drastically different ways. For example the warmer southern regions of the Mediterranean basin are particularly vulnerable to heat extremes, droughts, forest fires and are highly susceptible to the spillover effects of climate change outside of Europe. While in the Atlantic regions there is an increased risk of flooding, winter storms and heavy precipitation. The projected impacts of climate change will thus incur drastically different costs and damages in different regions (European Environmental Agency 2012a, p18) Therefore, it is clear that the impacts of climate change will be asymmetric. In practice this will mean the each region will need to have its own unique set of policy solutions. Hence, it makes sense to combat climate change through Cohesion Policy since it is already implemented at the regional level and allows for regions to design their own projects due to MLG. Finally, virtually all the available evidence and expertise points towards anthropogenic activity as the leading culprit behind the development of climate change. More specifically, the single largest

factor is the release of GHG as a result of anthropogenic activity, particularly carbon dioxide (CO2). From 1970 to 2010, 78% of all GHG emissions was CO2 as a result of fossil fuel and industrial processes (IPCC 2014, p5). Figure 2.3 presents a detailed breakdown of GHG emissions by sector.

Figure 2.3



(Source: IPCC 2014, p47)

It is evident that out of the five economic sector depicted in Figure 2.3, the lion's share of emissions are produced by the generation of electricity and heat production in 2010. The pull-out shows where GHG emissions of the 25% of the electricity and heat-production are attributed in terms of final energy use. Other energy which accounts for some 9.6% in 2010 are also emissions from the energy sector. This is not surprising as almost all economic activity requires energy (European Environment Agency 2012, p201). Given that anthropogenic GHG emissions are the central culprit in driving climate change, there is thus a strong rationale for investing in RES.

Taking these 3 features of climate change together it becomes evident why Cohesion Policy and the ESIFs in particular are being used to mitigate climate change. Cohesion Policy is used to address climate change, precisely because climate change will affect the economic and social cohesion of

the EU's regions. The different effects of climate change, in conjunction with its asymmetric impact on economic and social activities means investment in both mitigation and adaptation will be necessary. Thus, Cohesion Policy, implemented through the ESIF's is well placed and should deal with climate change (European Commission 2007, pp40-42). In addition, using the structural funds to invest in RES as a means of mitigating climate change is clearly a sound strategy given that one of the largest drivers of climate change is the release of GHG through fossil fuel use. Thus switching to RES has the potential to decrease GHG emissions considerably (IPCC 2014, p100, European Commission 2007, pp104-105, European Council of Auditors 2014, p8). An added advantage to funding the development of RES is that it directly impacts the energy sector, from which most emissions are produced. RES can therefore have a strong impact on climate change by replacing energy production from fossil fuel.

In conclusion, Cohesion Policy is one of the largest and most important policies of the EU. It's central aim is to alleviate the disparities of the EU's regions in terms of economic and social differences and inequalities by principally supporting those factors that lead to economic growth vis a vis generally large financial transfers. This process is labeled convergence and more broadly cohesion. The main implementation vehicle of Cohesion Policy are the ESIFs. The ESIFs are used to fund some national, but mainly regional projects that fall within agreed priorities throughout a set funding period. This dissertation examines the ERDF and Cohesion Fund in the period 2007-2012. Both funds had clear and strong priorities to invest in RES. The rationale behind this is quite clear. Climate change affects regions asymmetrically and will require heavy investment to adapt and mitigate, thus Cohesion Policy is well placed to address it. RES are of particular importance because of the potential to reduce GHG emissions - the main cause of anthropogenic climate change.

Literature Review – Chapter 3

In the previous chapter, a descriptive account and overview of Cohesion Policy laid out the foundations for this literature review. It drew together, the overarching nature of Cohesion Policy and elaborated in greater detail on the structural funds, particularly the ERDF and Cohesion Fund during the 2007-2013 funding period. It also connected these different aspects to the broader theme of climate change and specifically the link to RES. Additionally, it examined the rationale for funding RES through the ERDF and Cohesion Fund. The argument being made that Cohesion Policy is particularly well suited to funding RES and tackling climate change. In this chapter, a perusal and in-depth examination of theories which support this rationale is developed. Thus this chapter will examine the theoretical positions behind Cohesion Policy. In other words, which theories suggest it would work and which suggest it would not and why. In this manner theoretical positions can be arrived at that suggest Cohesion Policy would indeed have a positive impact on RES and by extension climate change.

As Chapter 2 made clear the overwhelming goal of Cohesion policy is the economic and social development of regions, in particular those regions that are lagging far behind (Hix and Høyland 2011, pp232-333). Within the academic literature there is much debate if this has actually occurred and what – if any - its impact actually is (Leonardi 1995, p33, Leonardi 2006, p161, Pike et al 2017, p50). Thus the first task at hand, with regards to this literature review is to examine how the impact of Cohesion Policy is understood within the literature.

In broad terms, there are traditionally two schools of thought regarding the impact of Cohesion Policy. On one side of the debate are convergence theories. Generally, they argue that Cohesion Policy has a positive impact in terms of growth and narrowing the level of disparities within the EU. These theories tend take a neoclassical or market perspective arguing that by supporting the free movement of goods, labor and services will under the right conditions begin to flatten disparities between different regions. Since Cohesion Policy does indeed support these different elements the argument goes that it should lead to convergence (Jovanovic 1997, p288). For example in neoclassical theory, the Structural Funds act as capital investments or are thought of as a kind of foreign direct investment in regions or countries suffering resource scarcity (Dall'Erba

& Fang 2017, p823, Recher and Kurnoga 2017). Overall, this position suggests that Cohesion Policy ought to support conditions in which markets functions most efficiently, which in turn leads to convergence. This is of course based on the assumptions that markets are efficient and tend towards equilibrium. Thus, in the absence of Cohesion Policy convergence would be much slower (Molle 2007, p3; McCormick 2011, pp172-176, Leonardi 1993, 1995). Much of the opposing theories with regard to Cohesion Policy has come out of an intense criticism of the assumptions made by the traditional convergence school of thought (Pike et al 2017, p50).

On the other side of the debate are divergence theories. According to these positions, Cohesion Policy is not causing convergence, instead it is argued that the system has an inbuilt tendency towards divergence. To be clear this does not imply a lack of growth, rather it suggests that ultimately regional growth will be uneven. In other words, it will cause disparities (Martin & Sunley 1998, p201, De Rynck and McAleavey 2001, p541). For instance Rodríguez-Pose and Fratesi (2004, p105) find little to no evidence of regional convergence, suggesting that while Cohesion Policy may well aim at convergence, the process of economic integration across the EU favors economic activity concentration and agglomeration. Therefore Cohesion Policy is more about mitigating the worst effects of a system that tends towards disequilibrium. Thus it ought to make an impact on those factors that help to mitigate the worst effects of regional growth (Molle 2007, pp17-21, Leonardi 1996, p34). With respect to RES this could be the financial support for the development of specific RES technology depending on the region in question. This would allow regions to develop sustainable energy infrastructure. According to the theory of cumulative causation, a system with initial disparities will tend to move towards increasingly uneven development if market forces are left unchecked (Myrdal 1956, 1957, cited in Molle 2007, p20). In this case Cohesion Policy should focus on unemployment as a result of other production factor movements and redistribution of the resources generated as result of the growth (Molle 2007, pp17-21, Leonardi 1996, p34). Under objective 2: Regional Competitiveness and Employment, Cohesion Policy attempts to focus on unemployment, this is done by the investment in innovation, R&D and infrastructure (European Commission 2007). However, it should be noted that divergence theories can account for possible convergence because the principal drivers of divergence theories such as location and economies of scale need not necessarily cluster around the core (Molle 2007, p21).

Consider the possible locations of solar panels for the production of electricity. Photovoltaic cells work best in conditions of long consistent solar intensity and radiation. Thus it follows that the best location for photovoltaic cells are not in the wealthy northern regions of the EU, but rather in the poorer south where geographical conditions are most amicable (Arvizu 2011, p342).

Recently and as a result of mounting empirical evidence, more nuanced approaches have attempted to explain the impact of Cohesion Policy. One such theoretical position suggests that both convergence and divergence occur over the long term as a region enters into different developmental stages. Hence, it is possible that Cohesion Policy does indeed cause convergence through the support of growth factors, however, as conditions change this may lead for a time to disparities increasing, growth nonetheless continues unevenly within region until it becomes increasingly developed, whereupon as a result of higher economic conditions regional markets begin to function more efficiently and the classical mechanisms of convergence take hold once more (Molle 2007, p21). However, all of these approaches do leave some uncertainties. As result several theories suggest that convergence and divergence are both simultaneous impacts of Cohesion Policy. These theories suggest that there are factors that spread economic growth and development out towards the poorly developed periphery regions, thereby leading to convergence. These factors are usually the lowering of transport costs, infrastructural development, and the availability of input factors (Martin and Sunley 1996). However, there are also forces acting in the opposite direction, these cause divergence. These tend be structural factors, such as the clustering of industry and technology as well as the comparative advantages that well developed centres provide (Molle 2007, p22, Martin and Sunley 1998, p201, Bouayad-Agha et al 2011, p1576). In addition developed centers also cause divergence because they provide a strong incentive for the relocation of factors of production to the core (Leonardi 1996, p40, Martin and Sunley 1996, p268-269).

From the above discussion it becomes evident that both sides of the debate agree that growth can occur, however, the real question of what has been the impact of Cohesion Policy hinges on whether this growth is converging the regional economies of the EU or if it is causing regional economies to grow in a manner that is compounding the disparities between core and periphery. Having presented the broad theoretical positions with regard to Cohesion Policy, it is now

necessary to examine the most relevant theories. Given that climate change will have an asymmetric impact on regions and that RES is a technology, location sensitive (e.g. wind, solar and hydroelectric) and a form of physical capital it makes sense to examine those theories that include these as relevant factors. Additionally, the nature of Cohesion Policy also matters, in particular its emphasis on MLG means that attention should also be payed to those theories that include regional and local actors.

One particular strand of theory emphasizing these factors is Endogenous Growth Theory. Essentially it argues that the foundations of regional development are largely immobile. Labor, technological inputs, capital and physical infrastructure do not move in response to market changes. According to endogenous growth theory, these factors tend to remain fixed to a particular location (Leonardi 1996, p40). This theory also emphasizes the role of regional and local governments in the development of a region. The participation of regional actors is seen as necessary in creating the conditions for the development of the aforementioned factors. Thus the aim of regional policy according to this theory is to support the necessary conditions for the movement of some of the basic factors influencing development. Technology and innovation play important roles in the development of a region and technological spillovers are geographically concentrated (Molle 2007, p22). Cohesion Policy and RES fit into this theoretical position. First, Cohesion Policy places importance on the involvement of local and regional governments through the MLG framework (Leonardi 2006, p160). Second, this theory places emphasizes on the ability of ESIFs to improve and foster the growth of technology (Bouayad-Agha et al 2011, p1575). Which in turn drives development, in terms of spillover and technological diffusion, innovation and attracting labor (Molle 2007, p22, Barro and Sala-i-Martin 1995 cited in Martin and Sunley 1996, p210). In this sense then this theory suggests that investment in technology such as RES may cause further development in RES vis a vis diffusion and transfer. Finally, this theory is also sensitive to geography. Therefore, it would appear that according to this theory, investment in RES through the structural funds is expected to work. Finally, this theory generally predicts convergence, however it also allows for divergence (Percoco 2017). Thus, it provides a good framework for understanding and predicting that the ESIFs would indeed lead to a growth in RES, however, the growth may well be uneven due to geographic factors and local economic structure.

New Economic Geography is a comparatively new theory of economic inquiry. It allows for both convergence and divergence as a result of numerous factors such as industrial location, agglomeration and intra/inter regional transport costs (Krugman 1998, p16, Martin and Sunley 1996, pp262-263). It should be noted that new economic geography places heavy emphasis on transport costs and basis its theoretical position on inter regional trade. This means that it is not directly applicable to the focus of this dissertation. Nonetheless, based on its description of uneven regional development using geography, natural resource disparities, historical accidents and path-dependencies, new economic geography suggests that regional industry clustering as a result of the aforementioned factors provides the justification for government intervention. This intervention should come in the form of incentives to develop technologies that are externalities and that help to foster and support local industries to specialize and develop. Crucially, according to Krugman (cited in Martin and Sunley 1996) this should occur at the level of the region. Additionally, several 'Schumpeterian' contributions have increasingly highlighted the importance that technology and technological spillover have as positive disruptive effect on regional economic structure (Pike et al 2017, p51). The great value of this theory with respect to this dissertation is that it allows for convergence and divergence. Investment in RES by the structural funds does not occur in a vacuum. RES itself requires the presence of skilled labor, materials require transportation and are location specific in terms of the renewable resource they are to utilize and in terms of space (e.g. wind farms and hydroelectric technology require large amounts of space). Overall this suggests, that RES growth as a result of Cohesion Policy may be very uneven.

Finally, it is worth examining two theories that are relevant by virtue of the nature of the structural funds. The ERDF and Cohesion Fund are by definition supra-national funds. Hence the principle of Fiscal Federalism is applicable here (Hix and Høyland 2011, pp232-333). In essence Fiscal Federalism involves the transfer of funds between territorial units - in this case regional units - through a central budget. Additionally, it seeks to address the problem of vertical assignment of responsibility for economic responsibilities. Usually the most efficient arrangement is to assign responsibility to the authority that corresponds to the taxpayer, however, when the benefits of fiscal transfers spillover into different territories it makes sense to centralize (Pädam et al 2010, p24). As the discussion of Cohesion Policy and RES pointed out, the benefits of investing in RES are

not regionally confined. This is a result of the integrated nature of the Single Market and energy infrastructure in Europe. In addition, anthropogenic climate change will affect all regions within the EU. Therefore, it makes sense to centralize funding to tackle climate change. In this case, it is the funding of RES as a means of curbing the amount of GHG released into the atmosphere. Finally, it is also worth noting that many of the economic theories of regional growth discussed earlier also highlight the role of technological diffusion and spill over into other regions. This further reinforces the fiscal federalist position (Faggini & Parziale 2016, p1069). The idea that fiscal transfer should be done at the federal level also implies that institutions play an important role. In recent years, the idea that institutions play an important role in regional economic activity and development has gained more attention (Rodríguez-Pose 2013). Likewise the theory of endogenous growth also places emphasizes on the role of regional governments. Combining these, MLG provides a solid theoretical framework for suggesting the Cohesion Policy is a good delivery vehicle for the development of regions. MLG is the concept that the policy process - from agenda to implementation - works best when a multitude of actors are involved (Leonardi 2006, p160). The inclusion of regional actors, allows them to develop and innovate by moving away from traditional institutional hierarchies (Heidbreder 2017, p.1369). It allows projects funded through the structural funds to be tailored specifically for a given region. Interestingly, this may actually result in divergence occurring. The reason for this is that regional actors will choose development policies that makes sense for their regions specific economic structure and context within the overarching framework of Cohesion Policy. In other words, regions may become more heterogeneous and have different outcomes as a result of Cohesion Policy (Percoco 2017, p835) Overall, it would seem that fiscal federalism and MLG provide a complementary theoretical position, which expect the structural funds to have a positive impact on RES. However, they do not suggest that convergence or divergence will occur. Rather they only suggest that Cohesion Policy is a suitable mechanism for the development renewable energy.

In conclusion, Cohesion Policy incorporates key elements of each theory. On this basis it is argued that Cohesion Policy through the ERDF and Cohesion Fund should have a significant positive impact on the development of RES. Fiscal Federalism and MLG provide a theoretical position that suggests Cohesion Policy should have a positive impact due to its structure, while New Economic

Geography and Endogenous Growth Theory highlight the importance of the regional level, geography and the role of sub-national governments in shaping development. With respect to what this dissertation can add to the literature, the value of this dissertation comes from the fact that it takes a very different approach to most of the literature. It does not focus on one particular region or country. Neither does it examine the impact of Cohesion Policy in terms of overall regional growth. Instead this dissertation examines what the impact Cohesion Policy was on one factor – RES – this is a technology and thus fits within most of the economic theories and schools of thought reviewed here. Thus it makes a contribution to the overall literature by attempting to clarify the impact of Cohesion Policy on one factor on an EU wide scale. Secondly, it also connects regional development policy to the issue of climate change. By investigating how a regional policy such as Cohesion Policy impacts on RES, which is a key component in the effort to mitigate climate change it helps to modestly further the understanding of the linkages between regional development and climate change.

Data and Methods – Chapter 4

In this section, the data and methodology will be discussed. This will include an examination of the indicators, methodology, rationale and potential problems. In order to conduct the analysis SPSS will be used.

Data sources are from DG Regio and Eurostat. DG Regio provides the independent variable which is total amount of funding given to each member state for renewable energy during the funding period 2007-2013 (European Commission 2010). Using this data, an indexing variable was created were each case of the variable is a country that received funds. Out of the EU's 28 members only 25 received funding. Those which received no funding were not included. These countries were: Croatia, Ireland and Denmark. The dependent variables are provided from Eurostat and are as follows:

- Primary Production of Energy from RES (Eurostat 2018a)
- GHG emissions in the Energy Sector (Eurostat 2018b)
- Share of renewable energy by gross final consumption (Eurostat 2018c)
- Real GDP Growth Rate in PPP (Eurostat 2018d)

In terms of data handling, the individual cases of the independent variables cases have the exact amount of euros received. In order to make the large amounts more manageable, each case was divided by 1 million, thus the independent variables values are in millions of euro. The advantage is that it makes the figures and tables more readable. The dependent variables required more work. They represent the change from 2007 to 2013. This was done to rule out the possibility of effects on the dependent variable prior to the commencement of the funding period. To do this, the value of each variable in 2006 for each country was subtracted from the value in 2013. Hence in absolute terms the raw change in the variable for each case was recorded. Finally, Real GDP Growth Rate in PPP followed the same procedure as the other dependent variables. It is included as control variable to account for economic development. Thus the difference from 2006 to 2013 needed to be calculated.

The rationale for choosing the dependent variables is that if the funds did have a positive impact on the growth of renewable energy and an increase in the utilization of RES then the first expected effect would be an increase in the primary production of energy from RES. This is the first dependent variable. The second dependent variable is the change in GHG emissions in the energy sector. Almost all forms of industry and economic activity require energy usually in the form of electricity or heat. As Chapter 2 showed, emissions from the energy sector or as a result of electricity and heat production account for a disproportionate amount of GHG. Therefore, the funding of renewable energy should cause a strong decrease in the amount of GHG emissions in the energy sector since GHG as result of fossil fuels ought to decrease as these are replaced by RES. Finally, the last dependent variable is included as a way of closely linking the quantitative analysis with the greater substantive issue at stake. The logic being that it may well be the case that primary production of energy from RES has increased as result of the funds and that the funds have caused emissions in the energy sector to fall, however, this is only meaningful if in the end point of energy consumption there is also a meaningful change. The reason for this is simply increasing RES is not enough to mitigate climate change. The increase must be notable and strong for any investment in RES with the goal of mitigating climate change to be meaningful in the long term. In other words, RES must permeate in all areas of energy consumption and usage. For these reasons, the share of RES in gross final energy consumption is included as the third dependent variable. Finally, Real GDP Growth in Purchasing Power Parity (PPP) is used as control variable to account for economic development as a potential driving force behind a growth in renewable energy. Economic development, is particularly useful as it will control to a certain extent market investments and government investments. Hence, using it as a control variable rules out this rival explanation.

Based on this rationale the following three hypothesis are formed:

1. Funding from the ERDF and Cohesion Fund caused primary production of energy to increase
2. Funding from the ERDF and Cohesion Fund caused GHG emissions from the Energy Sector to decrease

3. Funding from the ERDF and Cohesion Fund caused the share of renewable energy in gross final consumption to increase

In terms of the structure of the analysis, it will proceed as follows: first, the level of funding for each country will be presented visually and briefly discussed. Second, all variables will be presented using mean, median, mode, standard deviation and skewness. Third, correlations between all variables will be conducted. The main correlations of interest between the independent variable and the 3 dependent variable will also be presented visually using scatterplots. Finally, a multivariate regression analysis will be conducted while controlling for economic development. The main findings will be presented in a table.

At this point it is necessary to examine some of the potential difficulties associated with this dissertation. The first difficulty is the sheer scale and complexity of Cohesion Policy and climate change. This makes it very difficult to isolate factors or alternatively control for all the possible variables at work. The problem is that given the scale and complexity, there are almost always alternative variables that could be chosen and the national and regional policies of MS need to be accounted for (Martin and Tyler 2006, p202, Cancelo et al 2009, p1536). That being said, the single largest problem is isolating causality. To genuinely attribute causality to the ESIFs requires that every single project funded be investigated to clarify whither the project was possible only because of funding support. If the projects would have gone ahead regardless of funding support then causality cannot be attributed to the ESIFs and Cohesion Policy.

In conclusion, the 4 dependent variables described above are suitable measures to capture the impact of the ERDF and Cohesion Fund on the development of RES. Additionally, these variables are also closely linked to climate change mitigation as argued in Chapter 2. Therefore they are a good indicator to examine if Cohesion Policy is addressing climate change mitigation. Lastly, unlike most studies, this quantitative analysis has a very narrow focus in terms what it is measuring. This will go some way to avoiding the problems discussed above. It also differentiates itself from most studies analyzing Cohesion Policy.

Statistical Findings - Chapter 5

In this chapter the statistical findings will be presented. The discussion will focus on the statistical significance of the findings. The aim will be highlight interesting findings as well any potentially statistically unexpected results. First, a bar chart is presented to give a visual description of the ERDF and Cohesion Fund amounts that each MS received. This will be followed by a descriptive analysis of each variable in order to examine the shape of the date. Thus mode, median, mean and skewedness will discussed. Additionally, common trends between the variables are also examined. The third section will present the findings of the correlations and multivariate regressions. Finally, a conclusion will summarized the main statistical findings.

Figure 5.1

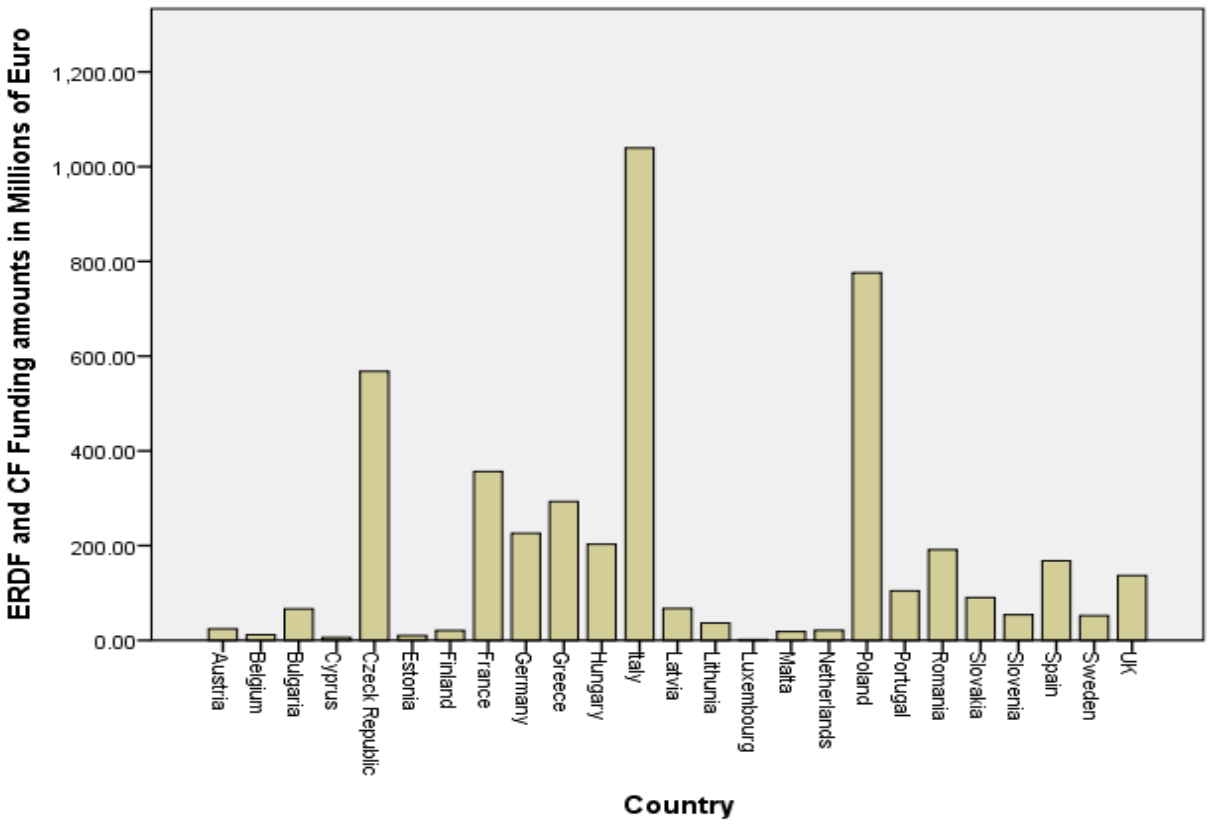


Figure 5.1 displays the level of funding received by each of the 25 MS during the 2007-2013 funding period. From the bar chart is it immediately obvious there is considerable differences in

the amount of funds each state received. Three main outliers are identified: Italy, Poland and Czech Republic. Additionally, there are several states that received comparatively small funding amounts, for example Luxembourg and Cyprus. The main thing of note is the considerably different levels of funding received by each state.

Table 5.1

Descriptive Statistics: Overview of all Variables

		ERDF and Cohesion Fund	Primary Production of Energy from RES	GHG emissions Energy Sector	Share of renewable energy in Gross Final Consumption	Real GDP Growth in PPP
N	Valid	25	25	25	25	25
	Missing	0	0	0	0	0
Mean		181.7482	2693.4920	-22.5095084	5.9480%	-4.7680%
Median		67.1800	1385.3000	-13.9335800	6.0000%	-3.9000%
Mode		1.77[a]	8.50[a]	-112.17565[a]	2.00%[a]	-3.70%[a]
Std. Deviation		258.56407	3511.47522	31.16969549	2.15002%	2.67500%
Skewness		2.240	1.871	-1.973	.020	-.516
Std. Error of Skewness		.464	.464	.464	.464	.464

a. Multiple modes exist. The smallest value is shown

Table 5.1 details the descriptive statistics of all variables used. There are a number of common findings here. The independent variable ERDF and Cohesion funding in euros has a mean of 181.7 million euros. This is quite high and given the bar chart presented on page 14, wholly inappropriate as result of the outliers: Poland, Italy and Czech Republic. These outliers are probably the cause for the positive skew. Thus, it is better use the median value of 67.2 million euros. Primary Production of Energy from RES, is also positively skewed. This means that there are several cases in the distribution that occupy higher values of the interval. Given the size of the skewedness it is better to use the median as an indicator for the overall change in this variable. The median increase in primary production of energy from RES from 2007-2013 was 1400 tonnes of oil equivalent. The fourth variable (counting from left to right) - Share of renewable energy in Gross

Final Consumption of energy has a mean of 6% and a median of 6%. The skewedness of the variable is also quite low. Overall this suggests that most values of this variable are clustering around the mean. Finally, GHG emissions Energy Sector has a mean of a 23 million tonnes decrease from 2007-2013. However, similarly to the first two variables the skewness is quite high. Therefore the median is probably a better indicator. The median value is -13.9 million tonnes approximately of GHG, in other words - a 13.9 million ton decrease in the energy sector from 2007-2013. Finally, the control variable also displays a significant amount of skewness. However, it is smaller than most of the other variables. The mean (-4.77) and the median (-3.9) are comparatively closer than all other variables except for the Share of renewable energy in Gross Final Consumption. Either mean or median could be used here. However, given that the skewness is still quite high, the median is probably a better indicator of the shape of the overall data. Overall, with the exception of the share in RES in Gross Final Consumption, there are similarities in terms of the strength of the skewness. The fact that the skewness is positive, is indicative that there are cases in each variable that occupy high values. Since each case is in fact representative of MS, this may well mean that there are considerable differences between the MS. In the sense that there are several MS that have very high values while the many other MS occupy considerably lower cases in each variable.

Having given a descriptive overview of the variables under consideration. The next step is to do a simple correlation analysis to test for possible significant relationships. Table 5.2 presents correlations of each dependent variable with the independent variable.

Table 5.2

Correlations

		ERDF and Cohesion Fund	Primary Production of Energy from RES	GHG emissions Energy Sector	Share of renewable energy in Gross Final Consumption	Real GDP Growth in PPP
ERDF and Cohesion Fund	Pearson Correlation	1	.484*	-.563**	.158	.030
	Sig. (2-tailed)		.014	.003	.452	.886
	N	25	25	25	25	25
Primary Production of Energy from RES	Pearson Correlation	.484*	1	-.727**	-.039	.334
	Sig. (2-tailed)	.014		.000	.852	.103
	N	25	25	25	25	25
GHG emissions Energy Sector	Pearson Correlation	-.563**	-.727**	1	-.072	-.271
	Sig. (2-tailed)	.003	.000		.732	.190
	N	25	25	25	25	25
Share of renewable energy in Gross Final Consumption	Pearson Correlation	.158	-.039	-.072	1	-.283
	Sig. (2-tailed)	.452	.852	.732		.170
	N	25	25	25	25	25
Real GDP Growth in PPP	Pearson Correlation	.030	.334	-.271	-.283	1
	Sig. (2-tailed)	.886	.103	.190	.170	
	N	25	25	25	25	25

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The linear correlation suggests that there is indeed some connection between the independent variable and the dependent variables. The independent variable correlates quite strongly with Primary Production of Energy from RES and GHG emissions Energy Sector. The correlation for the former has a value of .484 which is significant at the 0.05 level, however the strongest correlation between independent variable and dependent variable is the correlation of the ERDF and Cohesion Fund and GHG emissions Energy Sector. The Pearson's correlation value for this correlation is -.563, which is significant at the 0.01 level. These two correlations were expected based on the hypothesis. Additionally, there was a strong correlation between the two dependent variables Primary Production of Energy from RES and GHG emissions Energy Sector. This is highly plausible and expected, given that if production of energy from RES increases then it should result in a fall in GHG emissions in the Energy Sector as energy production from fossil fuels is phased out.

The linear correlation also indicates that there is no significant relationship between the ERDF and Cohesion Fund and the share of RES in Gross Final Consumption. This is disappointing, but not unexpected. The reason for this is that gross final energy consumption is a value derived from the gross final energy consumption of end consumers (all forms of energy from all different sectors) and includes grid loss and energy consumption by power plants. Hence there are numerous other factors at work that influence this dependent variable. Alternatively it might suggest that the funds did not dramatically affect the growth of renewables enough to be noticeable in this correlation. A final interesting finding is that the control variable Real GDP Growth does not have any significant correlations with any of the other variables. In order to emphasize the correlations between the independent and dependent variables discussed above, Figures 5.2 through 5.4 present the correlations visually as scatterplots on the following pages.

Figure 5.2

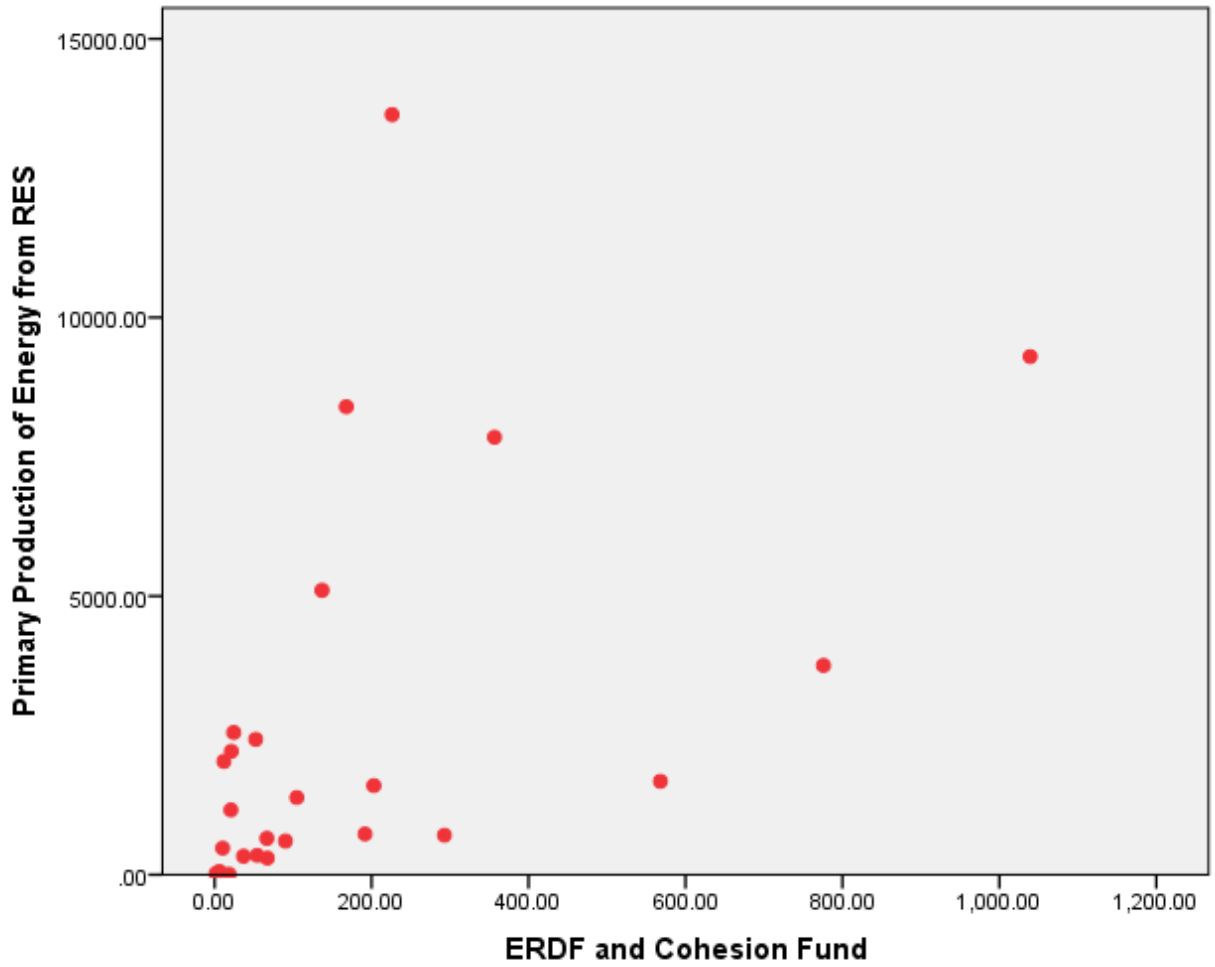


Figure 5.2 (previous page), depicts the correlation between ERDF and Cohesion Fund and Rrimary Production of Energy from RES. Clearly there is a positive correlation between the two variables. Most of the correlation is concentrated in the lower ranges of the independent variable and dependent variable. However, this is to be expected given that most countries received relatively small amounts of funding for RES. The major outlier to this is Italy, which received a disproportionate amount of funding yet is does not have the highest case in the dependent variable. While there clearly is positive correlation, nonetheless, from Figure 5.2 it can be remarked that the correlation could be stronger. Potential explanations might be that the level of market in investment is not known, neither is the level of government spending on RES.

Figure 5.3

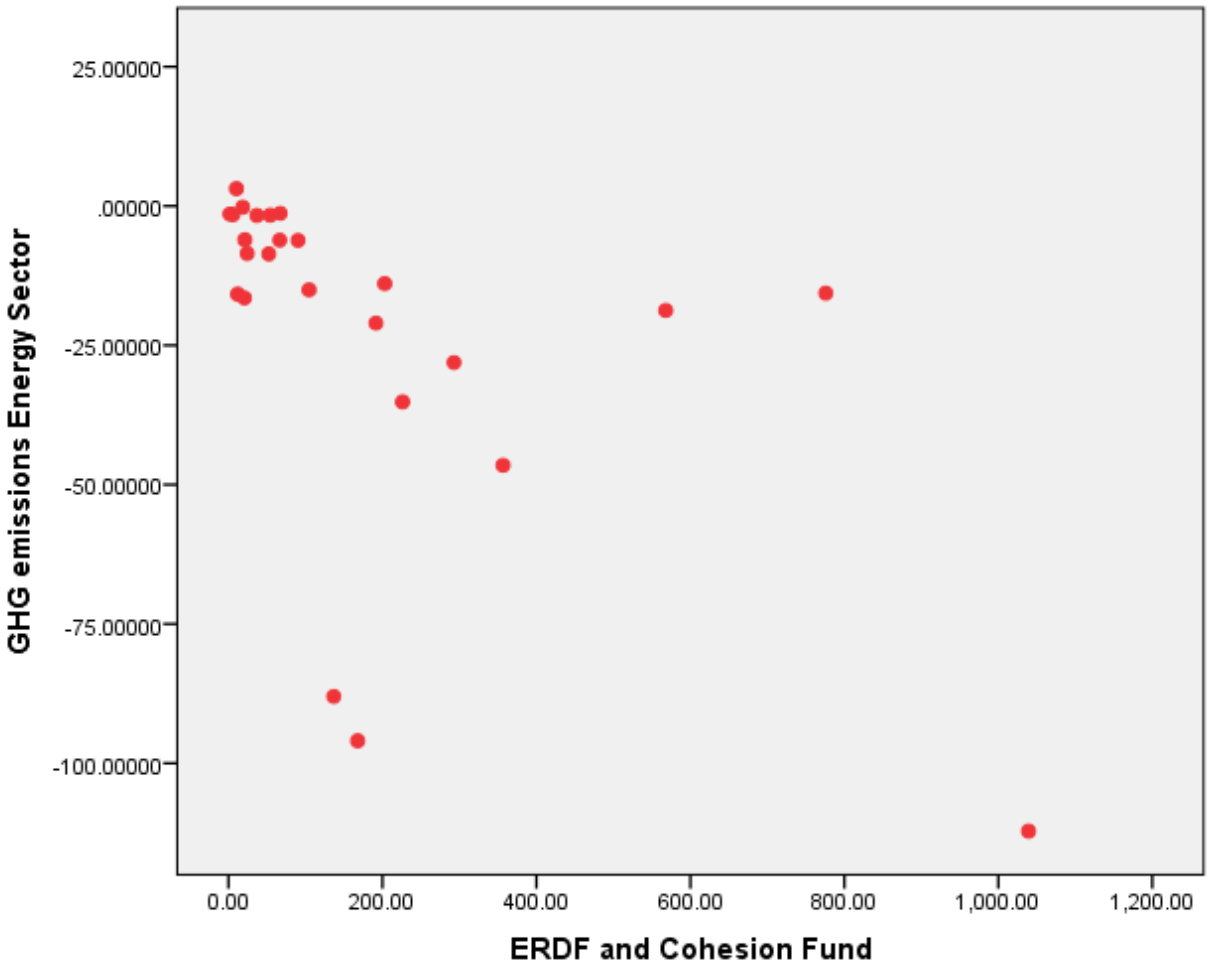


Figure 5.3 depicts the correlation between the structural funds ERDF and Cohesion Fund and GHG emissions Energy Sector. It is immiediatley obvious that the correlation is very strong although there are a few outliers. Once again Italy, which received the highest share of funding also has the largest decrease in GHG emissions in the energy sector. However, there are two cases in the bottom left of the scatter plot that have a large decrease in GHG emissions while having received comparatively small amount of ERDF and CF funds. Additionally, there are two further outliers that have received large some of investment in the top center of the scatter plot that do not show a large decrease in GHG emissions in the energy sector. Nonetheless, the vast majority of cases do show an extremely strong correlation.

Figure 5.4

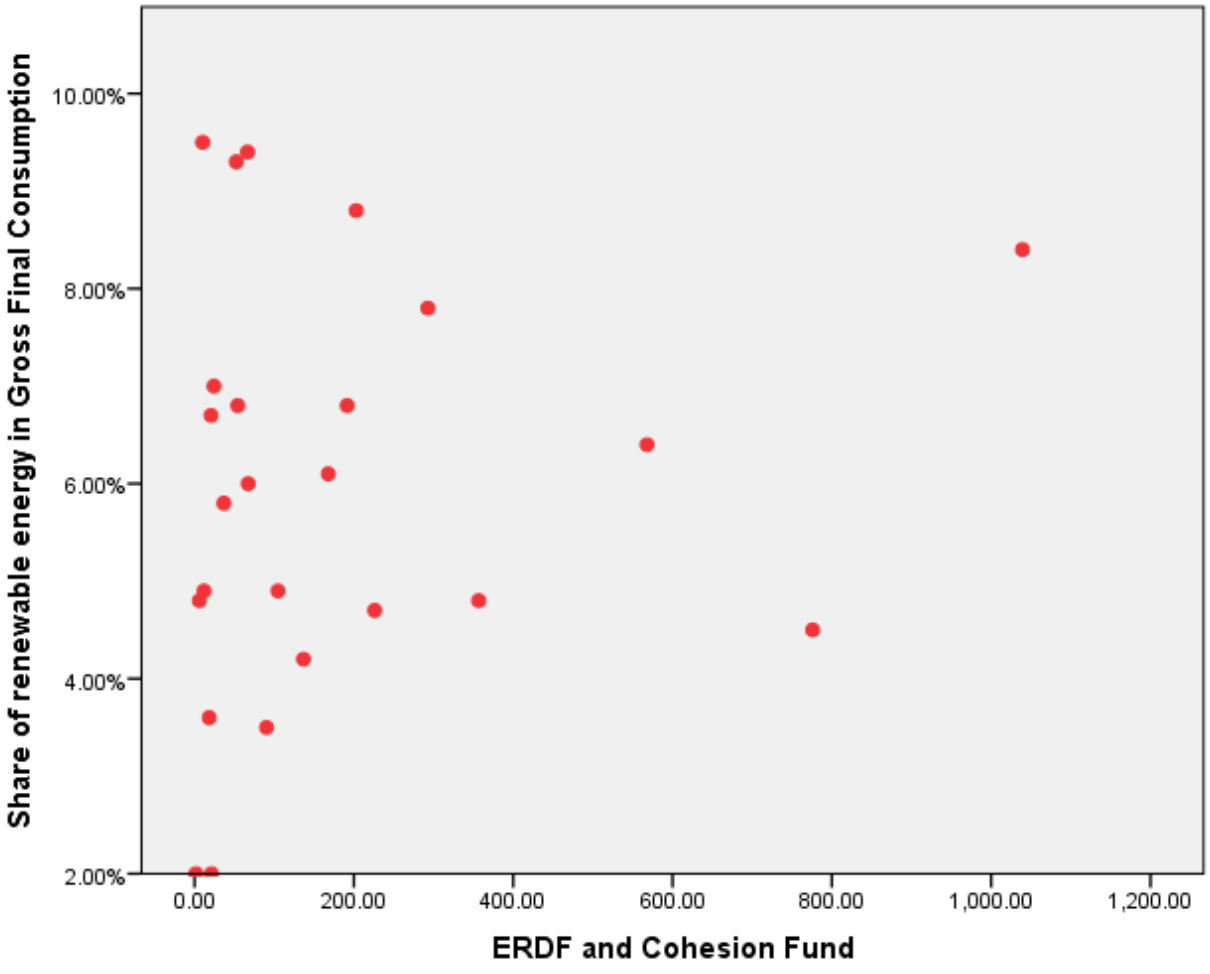


Figure 5.4 presents the correlation between ERDF and Cohesion Fund and Share of renewable energy in Gross Final Consumption. Clearly the correlation between the independent variable and

dependent variable is weak at best. It appears that the amount of funding had very little impact on the final share of renewable energy in gross final consumption.

Having examined the variables at a descriptive level and preformed correlations of the independent variable with all three dependent variables. The relationships between the variables will now be examined using multivariate linear regression. In order to do this, a multivariate regression analysis was done using the variable Real GDP Growth as a control variable for economic development.

Table 5.3

Variable	R-square	Regression Coefficient	t	Sig.
Primary Production of Energy from RES	0.336	6.435	2.726	0.012
GHG emissions Energy Sector	0.382	-0.067	-3.31	0.003
Share of renewable energy in Gross Final Consumption	0.108	0.001	0.826	0.418

Independent Variable: ERDF and Cohesion Fund

Control: Real GDP Growth

Table 5.3 displays the main findings of the multivariate regression analysis. Each analysis will be examined in turn.

Hypothesis 1: Funding from the ERDF and Cohesion Fund caused primary production of energy to increase.

The result is statistically significant, the p value of 0.012 is less than 0.05 and the t value is greater than 2. This means that the null hypothesis (ERDF and Cohesion Fund caused no increase in primary production of energy from RES) can be safely rejected. The regression coefficient indicates that for every 1 million euros spent, there is a corresponding increase in primary production of energy from RES of 6’435.00 tonnes of oil equivalent. Finally, the R-square of 0.336 means that funding from the ERDF and Cohesion Fund explains approximately 1/3 or 34% approximately of the change in the dependent variable. Given the statistical findings of the multivariate regression analysis, hypothesis 1 is accepted and it appears that ERDF and Cohesion Funding did indeed have a positive effect on the primary production of energy from RES.

Hypothesis 2: Funding from the ERDF and Cohesion Fund caused a GHG emissions from the Energy Sector to decrease

In the case of Hypothesis 2, the null hypothesis could also be safely rejected. Given that the p value is 0.003 and the t value is -3.31, well above the required -2. Based on this, Hypothesis 2 is kept. The R-square indicates that the independent variable accounts for approximately 40% of the change in the dependent variable. This is quite high and it is strong indicator that the funding of renewable energy by the ERDF and Cohesion Fund had a significant impact on GHG emissions in the Energy Sector across the 25 MS examined. Finally, the regression coefficient is -0.067. In real terms that means for every million invested through the funds, there was a 67'000.00 tonne decrease in GHG emissions in the Energy Sector.

Hypothesis 3: Funding from the ERDF and Cohesion Fund caused the share of renewable energy in gross final consumption to increase

As Table 5.3 clearly indicates the p value is 0.418, well above the necessary 0.05 for the null hypothesis to be safely rejected. Additionally, the t value is 0.826, this is far too small. Thus, the null hypothesis cannot be rejected. Hence, the conclusions is that Hypothesis 3 is incorrect. This means that the ERDF and Cohesion Fund did not have a significant impact on the share of renewables in gross final consumption. Even if the p value and t value are ignored, the effect of the independent variable is incredibly small. The regression coefficient is 0.001, which means that a 1 million euro investment by the ERDF and Cohesion Fund increased the share of renewables by only 0.001%. This amount is so small and cannot be considered a positive impact or a meaningful increase. Finally, the R-square value of 0.108, means that ERDF and Cohesion Fund investment account for only 11% approximately. Based on these findings, it is clear that the ERDF and Cohesion Fund caused no significant increase in the share of renewables in gross final consumption.

In order to conclude this chapter is worth briefly summarizing the main findings of the quantitative study. First, with respect to descriptive statistics, the standard deviation and skewness for all but 1 (Share of renewable energy in Gross Final Consumption) of the variables is quite high. Thus greater emphasizes should be given to the median or mode instead of the mean. More importantly

it indicates that there are considerable differences between the 25 MS examined. The multivariate regression analysis showed that statistically the ERDF and Cohesion Fund caused a significant increase in the primary production of energy from RES and caused a significant decrease in the GHG emissions in the Energy Sector. Hence, Hypothesis 1 and 2 are kept. However, the ERDF and Cohesion Policy investments did not cause a statistically significant increase in the share or renewable energy in gross final consumption. Therefore, Hypothesis 3 is rejected.

Discussion and Conclusions – Chapter 6

This dissertation set out with the aim of investigating what the impact of the ERDF and Cohesion Fund was on the development renewable energy and the utilization of RES during the funding period 2007-2013, and in this way assess what the impact of Cohesion Policy has been on climate change mitigation. In order to do so, a thematic overview examined Cohesion Policy's nature, development and structure. It also sketched out the nature of the ERDF and Cohesion Fund during the 2007-2013 funding period and the priority to support RES. The discussion then connected Cohesion Policy and climate change. Climate change is driven by anthropogenic GHG emissions as a result of fossil fuel usage. The lion's share of which comes from the energy sector. Given the potential for RES to replace fossil fuels, it makes sense that Cohesion Policy invest in the development of renewable energy. In addition, Cohesion Policy is particularly well suited in this endeavor precisely because it seeks to address social and economic disparities that climate change is predicted to worsen. Climate change will affect different regions in different ways since its impacts vary from region to region. Since Cohesion Policy is implemented at the regional level it makes further sense that Cohesion Policy be used a means of addressing climate change.

Theoretical positions are largely divided on the issue of what the impact of Cohesion Policy is. There are in general 4 main positions. The first school of thought argues that convergence is occurring, the second argues that divergence is occurring. However, in most cases the empirical evidence suggests that a more nuanced theory is needed. As result, the third schools of thought suggest that convergence and divergence occur consecutively, while the fourth school argues that convergence and divergence occur simultaneously. From an economic perspective, of particular relevance to this dissertation are endogenous growth theory and new economic geography. The former due to the role it places on sub-national governments, institutions and the immobility of physical capital and the latter because it takes into account how geography factors into the development of a region and the role of technologies. In both cases, investment by the ERDF and Cohesion Fund should be successful. Additionally, both theories can account for convergence and divergence. Finally, Fiscal Federalism and MLG also argue that Cohesion Policy would have a positive impact on the development of RES. Fiscal Federalism argues that the centralization of

resource distribution results in greater efficiency, while MLG argues that involvement of regional and local actors enhances policy.

With respect to the debate regarding convergence or divergence, this dissertation cannot give a conclusive answer, however, some inferences may be drawn from the descriptive statistics of the variables. The primary production of energy from RES varies considerably across the EU. If there was convergence regarding the primary production of energy from RES it would seem that the skewness of this variable would be lower. That being said, the variable was represented as the absolute change, thus it does not capture how significant the change was for each individual MS. The same line of reasoning is also applicable to emissions of GHG from the energy sector. Once again there was considerable skewness. None of this should be taken as conclusive evidence that convergence is occurring, rather it suggests that divergence is more likely.

The main finding of this dissertation is that the ERDF and Cohesion Fund did significantly cause an increase in the primary production of energy from RES and caused a major decrease in GHG emission in the energy sector. With regards to the substantive issue at stake, it suggests that Cohesion Policy is addressing climate change through the development of renewable energy in a positive manner. As the thematic overview argued, RES is an important factor in mitigating and adapting to climate change. Given that the multivariate regression analysis showed that ERDF and Cohesion Fund had a positive impact on the development of RES it is concluded that Cohesion Policy is beginning to address the issue of climate change by attempting to reduce the level of anthropogenic GHG emissions. In terms of theory, a number of possible explanations are possible at this juncture, according to endogenous growth theory and MLG, the inclusion and role of sub-national actors are the factors which caused the ERDF and Cohesion Fund to a positive impact on the development of RES as evidenced through the increased production of energy from RES and the decrease in GHG emissions in the energy sector. Complementing this is the theory of new economic geography, given the importance of geography in terms of RES and the climate change, part of the reason why the ERDF and Cohesion Fund had a positive impact may be the result of its focus on regional development. Finally, another explanation is that the ERDF and Cohesion Fund are centralized. According to Fiscal Federalism this ought to increase the efficiency of the funds. Thus it to can potentially explain why the ERDF and Cohesion had a positive impact on the

development of renewable energy. In real terms, it is probably a mix of the above theories. So far the analysis indicates that the impact of the ERDF and Cohesion Fund has been positive which suggests that Cohesion Policy in general is addressing climate change. However, Hypothesis 3 had to be rejected. With respect to the substantive issue at stake this is disappointing and worrying. The reason is that primary production can increase, emissions can decrease, but if climate change is to be meaningfully addresses in a way that makes a real difference then renewable energy needs to be increased to such an extent that it not only decreases emissions in the energy sector, rather it needs to make up the vast majority of gross final consumption. Therefore, while it is clear that the ERDF and Cohesion Fund had a positive impact on the development of RES, the analysis conducted in this dissertation suggests that with regards to the substantive issue at stake, the positive effect was not large enough. Thus assuming that the ERDF and Cohesion Fund are the cause for the growth in renewable energy - funding for RES must be increased if Cohesion Policy is to genuinely address climate change as measured through the share of RES in gross final consumption.

Finally, the concerns raised in Chapter 4 need to be addressed. The results of this study are significant, however, it is not possible to say that they are conclusive. While many possible rival explanation were ruled out by controlling for economic development in order for the findings to be conclusive it would be necessary to individually examine each project in order to ascertain that the projects would have occurred only with help of the ERDF and Cohesion Fund – otherwise responsibility cannot be assigned to the ERDF and Cohesion Fund.

In conclusion the findings of this dissertation should not in themselves be considered conclusive. However, it is hoped that this dissertation makes a modest, but valuable contribution to the understanding of Cohesion Policy with respect to renewable energy. What is clear is that climate change will affect us all in different ways. Renewable energy is an important way to mitigate the main driver of climate change – anthropogenic GHG emissions – given the significant results of this quantitative study, this dissertation tentatively suggests that Cohesion Policy is a suitable mechanism for developing renewable energy.

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