Environmental Policy in Scandinavia

An Analysis of Norway's Rising CO_2 Emissions

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Ch. 1 Introduction

1:1 Introduction

The Scandinavian countries of Denmark, Norway and Sweden are typically thought to be among the most progressive in the world in terms of environmental policy output, success and sustainability. However, in recent years the environmental performance of Denmark and Sweden in reducing CO_2 emissions has continued to improve while Norway's has worsened as seen in Figure 1. CO_2 emissions of both Denmark and Sweden have steadily declined according to data from the World Bank, while the opposite has occurred in Norway since the mid-1990s (World Bank 2013). Public opinion in all three countries shows strong support for environmental action and a general consensus that citizens find climate change to be a serious issue (Norwegian Social Science Data Services 2014; European Commission 2014). In fact, this message is consistent in Norway across party lines as more than 50% of people who voted for every different party in the last Norwegian election declared it was "very much like them" or "like them" to find it important to care about the environment as is seen in Table 1 (Norwegian Social Science Data Services 2014). Denmark and Sweden have the largest percentage of their population declaring that "climate change is the most serious issue facing the world as a whole" of all countries in the European Union; 39% of Swedes and 30% of Danes agree with that statement (European Commission 2014). What accounts for Norway's CO_2 emissions going up in recent years, while the CO_2 emissions in two countries with very similar political systems in the same geographical region have been doing the opposite? Furthermore, what roles are domestic and international politics playing?

As climate change and other serious threats to the environment continue to intensify, it is vital to understand which aspects of environmental policy succeed in mitigating these challenges. When the performance of a country that is typically regarded as a pioneer in this realm of policy shows a decline, it is of paramount importance to uncover which factors are contributing. Additionally, there could be an issue of agency loss due to the overwhelming public support for environmental action and the dramatic increase in CO_2 emissions, as Norway is a representative democratic state and thus environmental policy is expected to mirror the concerns of Norwegian citizens (Bergman and Strøm 2011). Furthermore, this issue is especially salient given the near collapse of the Norwegian government in December 2016, when different political parties could not come to a consensus on what portion of the 2017 budget should be allocated towards environmental concerns, and in particular whether or not the carbon tax should be increased (News in English Norway 2016). The dominant argument for the recent rise in emissions in Norway is that it is due to the fact that Norway is a large oil and natural gas producer. This thesis does not attempt to disregard this as a major factor, but as seen in Figure 1 below Norway decreased and stabilized emissions in the early 1990s, despite being a major oil and natural gas producer since 1975 after the first major oil reserve discovery and production of the Ekofisk field in 1971 and the founding of Norway's largest oil company, Statoil, in 1972 (Regjeringen Norway 2013). Therefore, it seems there is more to this rise in emissions than simply oil and natural gas production. The real puzzle is why emissions did not continue to decline once they were stabilized during 1990-1995, as was the case in Sweden and Denmark. This thesis seeks to test possible correlations between the rise in CO_2 emissions and consequential decline in environmental performance of Norway juxtaposed to Denmark and Sweden. Due to the complexity of this issue, I include both economic and political variables to more accurately pinpoint where policy reforms would be most effective. Specifically, there are four categories of variables that I observe: two possible political influences, one at the international level and the other at the domestic or national level and economic variables of domestic production and consumption. The domestic political variable I observe is the political party of the Prime Minister as well as the party of the head of each country's respective environmental ministry.[1] The international political variable examined is European Union (EU) membership. Additionally, I look at production economic variables and consumption economic variables to further understand if it is Norwegian consumption or Norwegian production that is contributing to this increase in emissions. The production economy variables observed are oil and natural gas production. Finally, the consumption economy variables are sales of diesel and gasoline, GDP/capita and population density. The qualitative time frame is from 1990 to 2013 since this is when the discrepancy between the three countries' quantity of CO_2 emissions becomes evident (See Figure 1). However the quantitative data primarily goes back to 1995 due to data limitations and will be presented through linear regressions estimated by the statistic analytical system STATA.

I find that the economic variables representing domestic production do in fact appear to be contributing factors to the increase in Norwegian CO_2 emissions. However, I also find domestic politics to be playing a role. It appears that there are political influences

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[1] I also examine Norway's Ministry of Petroleum and Energy separately as there are not ministries of petroleum in Denmark and Sweden.

behind the production economy of Norwegian oil and natural gas that are not only influential, but also largely overlooked. Furthermore, I observe that the consumption economic variables of diesel and gasoline usage do not seem to be major factors in the observed increase in CO_2 emissions. This suggests that Norwegian citizens' fossil fuel usage is not where policy reforms should be focused. European Union membership also does not appear to be an influential factor. Thus my final policy recommendation is for the Norwegian government to focus on domestic policies that affect oil and natural gas production, such as the issuance of oil production licenses. This is necessary for the well-being of the planet as well as to be accountable to Norwegian citizens' concerns and those of other countries to which Norway has made climate agreements.

Figure 1: Metric Tons of CO_2 per Capita in DK, SW and NO annually 1960-2013

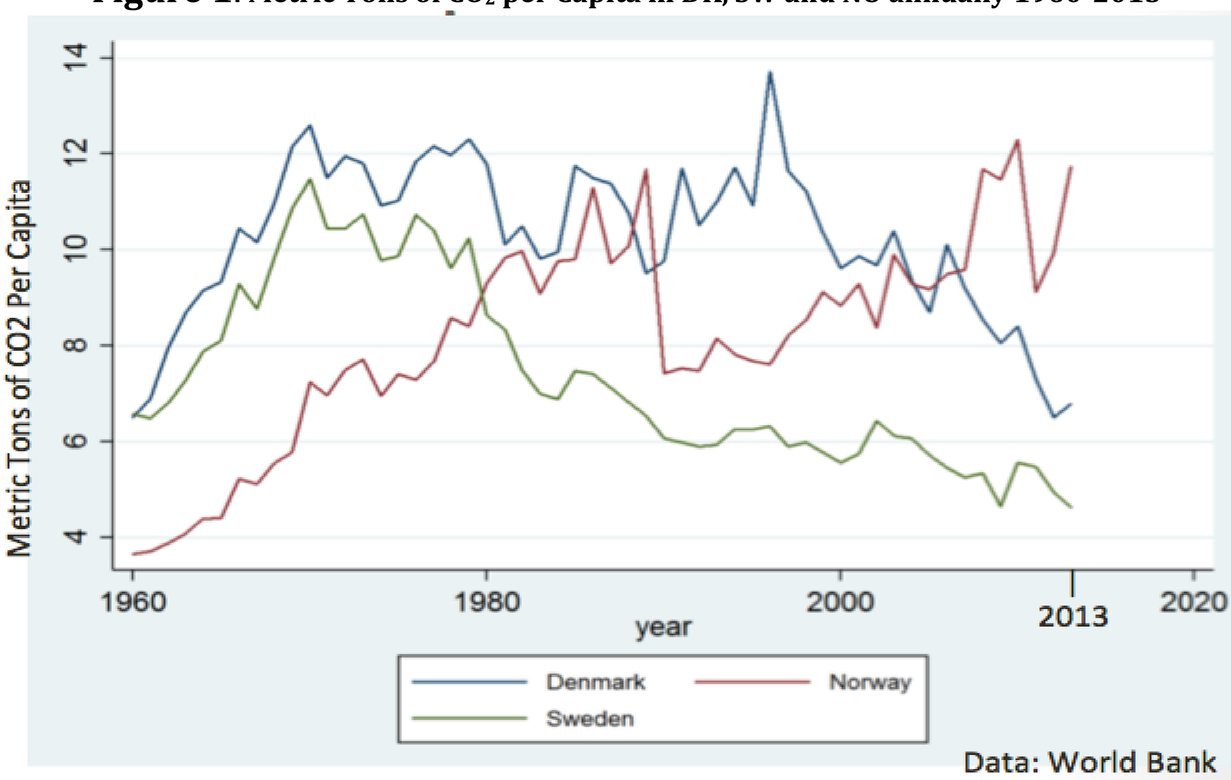


Table 1: Norwegian Public Opinion regarding "Importance of Caring for Nature and Environment"

Party voted for in last national election, Norway / Important to care for nature and environment	The Party Red (RØDT)	Socialist Left Party (SV)	Labour Party (A)	Liberal party (V)	Christian Democratic Party (KRF)	Centre Party (SP)	Conservative Party (H)	Progress Party (FRP)	Coastal Party (KYST)	Green Party (MDG)	Other	Total
Very much like me	27.3	38.8	21.0	26.2	17.3	22.0	13.7	18.7	50.0	63.0	26.7	20.7
Like me	63.6	40.8	42.6	53.8	44.2	50.8	37.5	37.3	0.0	33.3	40.0	41.4
Somewhat like me	9.1	14.3	20.7	15.4	26.9	11.9	22.0	19.4	0.0	0.0	13.3	19.4
A little like me	0.0	6.1	13.0	4.6	9.6	13.6	18.9	18.7	50.0	3.7	6.7	14.2
Not like me	0.0	0.0	2.4	0.0	1.9	1.7	7.3	4.5	0.0	0.0	6.7	3.8
Not like me at all	0.0	0.0	0.3	0.0	0.0	0.0	0.6	1.5	0.0	0.0	6.7	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N=	11	49	338	65	52	59	328	134	2	27	15	1,080

Data: European Social Survey, 2014

1:2 Summary of Hypotheses and Methods of Inquiry

Production Economy

Perhaps the most plausible explanation to this trend of increasing emissions in Norway, that will be observed as a production economy variable for this thesis, is that this country is a large oil and natural gas producer and exporter for the world market. While Denmark has an insignificant amount of these resources relative to Norway, and Sweden has virtually none at all this is one of the major differentiating factors between the three

Scandinavian countries (U.S. Energy Information Administration, 2014). Undoubtedly the process of extracting oil and natural gas has environmental consequences and this is exacerbated as oil fields become depleted since more energy for extraction is required despite the smaller amount being extracted (Gavenas, Rosendahl and Skjerpen 2015). This hypothesis will be tested by looking at the correlation of thousands of barrels of oil and natural gas produced annually and CO_2 emissions. It is expected that if this is a contributing factor, the years where there is a relative increase in oil and natural gas production in Norway will also show a relative increase in CO_2 emissions.

Consumption Economy

Another hypothesis, and consumption economy variable, is that Norwegians travel farther distances by car since Norway is less urbanized than Denmark and Sweden (World Bank 2016). The variable that will be measured is the effect of urbanization, and therefore kilometers traveled, on CO_2 emissions where urbanization is defined as an increase in population in cities and towns versus rural areas. Since Norway has a lower percentage of urban population than Denmark and Sweden, or in other words there is more of the population that lives in rural areas, it can be assumed that Norwegians must travel by car more than in the other two countries (World Bank 2016). Furthermore, it is common for Norwegians to have second homes located a significant distance from their primary homes. The Institute of Transport Economics Norwegian Centre for Transportation Research conducted a survey that found, on average, Norwegians make nineteen trips per year to second homes in Norway (Farstad and Dybedal 2011). Consequently, the more kilometers traveled the more fuel is likely to be used. It is expected that higher CO_2 emissions will be observed in years that more kilometers were traveled in Norway and consequently more diesel and gasoline was purchased. This will be measured by comparing how much diesel and gasoline has been purchased in each country over time to CO_2 emissions.

Finally, GDP per capita and population density are also consumption variables that will be examined. I hypothesize that an increase in GDP per capita will contribute to an increase in CO_2 emissions as the more wealth attained by citizens is likely to lead to an increase in fossil fuel consumption and therefore CO_2 emissions. As people become wealthier, they typically buy larger homes and bigger cars which both demand energy usage. I expect the opposite to occur with population density because although population may be increasing, if the amount of people in a country are more densely distributed then it has the potential to lead to a centralization of energy consumption and transportation infrastructure. For example, instead of the necessity to build infrastructure to heat homes in many different parts of a country due to the population being sparsely spread out, this infrastructure can be centralized and still provide heating for the same number of people.

Domestic Politics

A plausible hypothesis that will be tested is political party preferences and power in decision making over recent years as a representation of domestic politics. Denmark, Norway and Sweden are all governed under parliamentary democracy systems which entails having appointed ministers lead different executive departments (Bergman and Strøm 2011). For example, each country has its own respective ministry regarding the climate and environment. It is plausible that when these ministries are headed by a cabinet minister belonging to a political party that does not consider the environment to be of as much importance as other issues, there will be fewer environmental policies implemented and put into action. This will be tested by comparing CO_2 emissions levels over time to manifesto data of the party the Prime Minister is a member of and the political party of the head of each country's respective environmental ministry. It will be examined if there is a correlation between an environmental ministry being headed by a party that asserts less concern for the environment and rises in CO_2 emissions. Being that Norway also has a Ministry of Petroleum and Energy, while Denmark and Sweden do not, this will also be tested as it is similarly conceivable that the interests of the head of this ministry could effect emissions. If there is such a correlation, I expect that when the head of each country's Prime Minister and respective ministries of the environment is a member of a party that is relatively less concerned about the environment this will be reflected through an increase in CO_2 emissions.

International Politics

An alternative possible explanation, and representation of international politics, is European Union membership. Norway is not a member of the EU while Denmark and Sweden are, even though all three are members of the European Economic Area. CO_2 emissions have stabilized or declined in every European Union member country since 1990, with exception of the Baltic countries Latvia, Lithuania and Estonia (World Bank 2013). This could potentially mean that Norway has fewer environmental regulations to follow and also faces less accountability for not reaching emission reduction goals. This hypothesis will be tested by checking if years when there were major structural changes to the EU that effect the process of environmental regulation implementation at this level see a decline in CO_2 emissions in Denmark and Sweden as well. If EU membership is contributing to the success of these countries' environmental performance then it is likely that after the EU makes more stringent emission reduction goals, Denmark and Sweden will toughen their national policies in this area leading to a decrease in emissions.

1:3 Importance of Reducing CO2 Emissions/Dependent Variable

Cutting down CO_2 emissions is imperative to combatting climate change as it is argued to be the most important aspect of mitigating man-made climate consequences (Pierrehumbert 2014). Carbon dioxide emissions produced by human activities, primarily through burning fossil fuels such as coal, oil or natural gas, have been proven to negatively alter the Earth's climate (Victor 2011). By the 21st century, the primary source of global mean surface warming was determined by cumulative emissions of CO_2 over time (IPCC 2013). Additionally, there is no "sustainable" CO_2 emissions rate compatible with climate stabilization (IPCC 2013). Therefore unless CO_2 emissions fall to essentially zero, the climate will continue to warm indefinitely and the consequences of this will ensue (IPCC 2013). The vast majority of scientific experts are in agreement that without a major reduction in CO_2 emissions, and thus a massive change in the way humans produce energy, environmental problems will continue to be exacerbated. Raymond Pierrehumbert, a professor of physics at the University of Oxford and lead author of the *Third Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC), recently conducted a large and convincing study regarding the importance of reducing CO_2 emissions and stated, "Until we do something about CO_2, nothing we do about methane or these other things is going to matter much for climate… If you're serious about protecting climate, it's the CO_2 you've got to deal with first" (Reiter 2014).

The increased warming of the planet due to the continued release of CO_2 emissions poses long-lasting threats to all components of the climate system (IPCC 2013). This includes higher chances of "severe, pervasive and irreversible impacts for people and ecosystems" through more frequent and severe rain storms, longer and more intense heat waves and a rise in sea level that is the result of continued warmth and acidification, according to experts (IPCC 2013). Perhaps the most concerning aspect of global climate change is that even if humans stopped releasing all CO_2 emissions today, the impact of what has already been released will continue for centuries (IPCC 2013). Further, these consequences consistently intensify as emissions increase, which unfortunately has been the observed trend worldwide (IPCC 2013). However, despite the alarming and persuasive scientific evidence that there will be extreme consequences for the planet due to excessive anthropogenic emissions, it is still possible to mitigate these effects. This requires a significant reduction in all greenhouse gas emissions over the next several decades, and nearly zero levels of CO_2 emissions by the end of the century (IPCC 2013). In order for this to be accomplished substantial changes in technology are necessary, and in particular the way in which humans produce energy will require significant economic, social and institutional adaptations (Victor 2011). This will primarily be accomplished through successful policy measures.

However, since CO_2 emissions are interwoven with energy systems which take a considerable amount of time to change, and the effect of CO_2 emissions can last for thousands of years, this is one of the most difficult areas for governments to implement policies that successfully make a difference (Victor 2011; IPCC 2013). This is heightened by the fact that international cooperation is necessary to regulate CO_2 emissions as climate change is a collective action issue on a global scale (Victor 2011). Climate change simply cannot be effectively mitigated without global collaboration and cooperation. As seen in past efforts, governments have had trouble making credible promises on how quickly they can make significant cuts in CO_2 emissions; there have been considerable emissions reduction targets made with little success in actually achieving them (Victor 2011). One large example of this is the withdrawal of the United States, which is one of the world's largest emitters, from the Kyoto Protocol, which had set emission reduction targets for 38 countries (Victor 2001). This inability to keep emission reduction promises is in part due to the fact that countries cannot plan how much their economies will grow or the technological changes that will evolve (Victor 2001). It seems that many countries are well intentioned in addressing this issue, yet still uncertain how quickly they can make the necessary adaptations (Victor 2011). Furthermore, it is extremely costly to adapt current energy systems and many governments do not want to make the commitment to do so without confidence that other countries are making credible and comparable commitments (Victor 2011). It is for these reasons that climate change and particularly CO_2 policy needs careful restructuring. If any country is capable of doing so, it is Norway as it is a wealthy, developed country with both citizens and politicians declaring this is an issue that is important to address.

1:4 Chapter Outline

The structure of this thesis is as follows: Chapter Two will summarize the main arguments in the existing literature regarding the aforementioned four categories of variables as well as the theory behind why these variables have been chosen, Chapter

Three will give a more detailed explanation of the chosen case studies by examining the similarities and differences of each of the three chosen countries as well as give a history of each country as an environmental actor, environmental policies and overview of the environmental agreements and targets they have made nationally and internationally, Chapter Four will describe the research design, data sources, methods of analysis, and operationalization of each hypothesis, Chapter Five will provide a discussion of the interpretation of the results in Chapter Four and how they compare to the hypotheses and finally, Chapter Six will give a conclusion with the summary of findings and implications for Norwegian policy.

Ch.2 Literature Review and Theory

The literature specifically looking at Norway's rising CO_2 emissions is very limited. Observing domestic and international political variables as well as production and consumption economy variables, while also examining the divergence in CO_2 emission reductions between the three Scandinavian countries in one report is my contribution to the topic. It is important to look at many different potential contributing factors, as well as what two neighboring countries with similar political systems have done to curb emissions, in order to more clearly understand where to specifically focus policy reforms that can successfully address this issue. In this chapter I will provide the theory behind the variables I have chosen while making references to the existing literature.

Domestic Politics

Under the Norwegian constitution the cabinet, or Council of State, has far-reaching power as the central administration (Strøm 1994). This branch of Norwegian government creates most legislation that is adopted by the Parliament and can issue decrees when Parliament is not in session (Strøm 1994). It is also given the power to implement legislation and often can delegate authority to individual ministries (Strøm 1994). Cabinet ministers are administrators and specialists in the fields of their respective ministries and thus legally in charge of the ministry (Strøm 1994). It is important to note that they represent the political parties they are a member of in the cabinet as well as their individual ministry (Strøm 1994). When there are cabinet discussions, cabinet ministers tend to only participate in debates regarding their own field as this is their area of expertise (Strøm 1994). Given their influence in the cabinet, which ultimately under the

Norwegian constitution has the authority to draft and implement policies, cabinet ministers can have large effects on policy output related to their specialization. They can choose which policies under their jurisdiction they will fight for during discussions and questionings, and which they will not. It is for these reasons that the heads of the Ministry of the Environment and Climate and Ministry of Petroleum and Energy will be examined over time in Norway. Additionally, the respective environmental ministries in Denmark and Sweden will also be observed which have very similar delegations of authority (Bergman and Strøm 2011).

The Norwegian Prime Minister is the leader of the government and the head of the cabinet and must approve all decisions made by the cabinet (Strøm 1994). Additionally, they must prepare the cabinet agenda and chair meetings (Strøm 1994). Although they cannot technically dismiss cabinet ministers, they do have the power to request information from any cabinet member (Strøm 1994). Given that the Prime Minister can essentially set the political agenda and must approve the policy decisions made in the cabinet, this is another important domestic political factor to be taken into account.

An explanation for Norway's rising CO_2 emissions that is examined in the existing literature is that carbon taxes in Norway have a very minimal effect on curbing emissions. Carbon taxes in Norway are among the highest in the world suggesting there should be a decline in CO_2 emissions if the taxes were accurately incentivizing a lower use of carbon heavy energy systems (Bruvoll and Larsen 2002). Clearly, carbon taxes in Norway are not working as well as intended as it has been estimated by Annegrete Bruvoll and Bodil Merethe Larsen that from 1990-1999 there would have been a 21.2% increase in CO_2 emissions without a carbon tax and instead there was a 18.7% rise in emissions (Bruvoll and Larsen 2002). This small decline in emissions credited to carbon taxes indicates that carbon taxes have the potential to facilitate a decline in emissions if they are implemented decorously. This is not a specific domestic political factor that will be quantitatively tested in this thesis but will be qualitatively assessed in the proceeding chapter and it is important to acknowledge it as a representation of Norwegian domestic policy regarding CO_2 emissions.

International Politics

One large distinguishing factor of Norway compared to Denmark and Sweden in terms of international politics is that Norway is not a member of the European Union while the other two countries are. The EU has extensive influence over its member states in terms of environmental policy (Knill and Duncan 2007). Members of the EU are often required to adapt their national regulations, policies and administrative structures in a manner that fits with EU regulations and goals (Knill and Duncan 2007). If a member state does not fulfill its obligations to adhere to environmental standards at the EU level it is possible that it will lose some level of accountability to the other 27 members. This is due to the fact that many EU environmental targets are set not only at national levels for member states but also the EU as a whole (European Commission 2017). For example, the EU has a target of cutting greenhouse gas emissions by 20% by 2020 compared to 1990 levels and in an effort to achieve that goal has given targets to all member states as well (European Commission 2017). If a European Union member does not meet its 2020 target it jeopardizes the entire EU from meeting its goal as well. Although Norway is a European Economic Area member and thus does follow many international level environmental regulations, it has not held the same accountability to the EU as member states do.[2] It is plausible that Norway's decision to not join the EU has had an impact on CO_2 emissions that perhaps has been overlooked. To my knowledge this hypothesis has not been tested yet and therefore is worth looking into when trying to uncover why there is this divergence in CO_2 emission reductions between Norway and the other two Scandinavian countries.

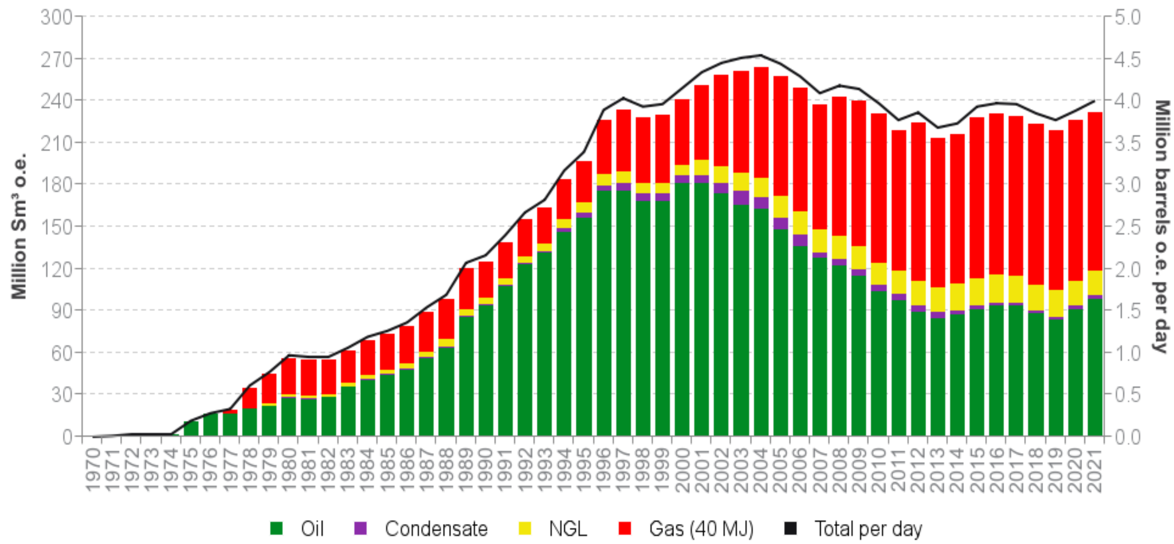
Production Economy

A dominant argument in the literature is that Norway's large production of oil and natural gas is the root cause for the observed increase in emissions. Understandably, extracting large quantities of oil and natural gas will have negative effects on the climate, and in particular CO_2 emissions. The Norwegian government has found oil and natural gas extraction to be the largest contributor to all greenhouse gas emissions coming from the country since 1990 (Statistics Norway 2015). Additionally Norwegians are more likely to use oil and natural gas as a fuel source since it is easily available to them. However, Norway's oil and gas production really started to take off in 1975, and oil and natural gas production has steadily increased since first being discovered until about 2005 when production started to level off and see a slight decline as is seen in Figure 2 (Norsk Petroleum 2017). If this is the direct cause of rising CO_2 emissions, one would not expect the observed decrease and stabilization in emissions in the early 1990s and there would have been an expected decline in emissions since 2005 since oil production declined slightly, yet emissions have continued to increase. However, a report by Ekaterina Gavenas,

[2] In 2015, Norway did sign on to a bilateral agreement with the EU to act as a full EU member with regards to reducing CO_2 emissions which will provide an opportunity to see how this effects Norway's accountability to the EU in the future (Climate Action Tracker 2016).

Knut Einar Rosendahl and Terje Skjerpen finds the reason for this continued increase in emissions despite relative stabilization in oil and natural gas production in recent years to be caused by Norwegian oil and natural gas fields' decline in extraction capacity (Gavenas, Rosendahl and Skjerpen 2015). In other words, after looking at all oil and natural gas fields in Norway they find that emissions per unit of extraction significantly increase the more depleted the field already is (Gavenas, Rosendahl and Skjerpen 2015). Specifically, they estimate that a field producing 20% of its peak level will emit about three times more than at the peak phase of production (Gavenas, Rosendahl and Skjerpen 2015). They also find that emissions intensities increase significantly relative to the share of oil in the field's original oil and gas reserves (Gavenas, Rosendahl and Skjerpen 2015). Their conclusion is that the larger the oil and natural gas fields are to begin with and the longer they are extracted, the more emissions will be released (Gavenas, Rosendahl and Skjerpen 2015). Due to these findings, Norway's long time frame of being a large oil and natural gas producer and the recognition by the Norwegian government that this is the single largest contributor to CO_2 emissions, it is very important that the amount of oil and natural gas production over time is an included variable in this study.

Figure 2: Historical and Expected Production of Oil and Gas in Norway, 1970-2021



Data: Norsk Petroleum

Consumption Economy

The existing literature also largely focuses on Norway's increased wealth, primarily due to oil and natural gas extraction, as the central explanation for rising CO_2 emissions. The argument is that since GDP has increased dramatically in Norway in the last two decades, Norwegians have a higher standard of living, are using more energy and thus emitting more. Furthermore, when a country becomes more affluent technological advancements can be anticipated. The standard formula in the literature regarding the connection between affluence, technology and population is that the impact on the environment (I) = Population (P) times Affluence (A) times Technology (T) or I= PAT (Dietz and Rosa 1997). A study by Thomas Dietz and Eugene A. Rosa published by the National Academy of Sciences of the United States found that this formula is true when specifically looking at CO_2 emissions as well (Dietz and Rosa 1997).

A report by Petter Næss and Karl Georg Høyer titled *The Emperor's Green Clothes: Growth, Decoupling, and Capitalism* argues that continual economic growth and long-term environmental sustainability are incompatible (Næss and Høyer 2009). They use Norway as a case study to exemplify that decoupling the link between economic growth and environmental degradation is extremely limited (Næss and Høyer 2009). They state that since Norway, Denmark and Sweden have gained international praise for their achievements in environmental politics both domestically and internationally, then Norway is a country where decoupling should be demonstrated, if decoupling is possible, being that its wealth has risen the most of these three countries (Næss and Høyer 2009). However, the report found that decoupling has not taken place in any meaningful way in Norway taking into account gross consumption of primary energy, including both direct and indirect energy, gross emissions of total greenhouse gas CO_2-equivalents, including both direct and indirect emissions and gross ecological footprints (Næss and Høyer 2009).

Although technology specifically is not a variable I will be examining, GDP per capita as a representation of wealth and population density are both important variables to include when looking at Norway's CO_2 emissions increase. I make the assumption that there are two primary ways Norwegian citizens will respond to increased wealth: purchasing bigger homes and higher quantities of, as well as larger, cars. Larger homes will require more energy for electricity and most cars will require fuel to run (the exception being purely electric cars). However, there is one aspect to Norway's consumption economy that I believe has been overlooked and that is hydro-electricity's dominance in providing energy, a renewable method that has nearly zero emissions (Center For Climate and Energy Solutions 2016). Around 95% of Norwegian electricity consumption is produced through hydropower (International Energy Agency 2011). This is why when examining the effects of the consumption economy in Norway I decide to focus on diesel and gasoline sales as a representation of increased car usage, rather than on the increased electricity needed to power homes.

There has been an observed shift towards using more diesel fueled cars in Norway than gasoline and diesel is now believed to be a larger emitter of CO_2. According to the U.S. Energy Information Administration, about 19.64 pounds of CO_2 are produced from burning a gallon of gasoline that does not contain ethanol and about 22.38 pounds are produced from burning a gallon of diesel fuel (U.S. Energy Information Administration 2016). Given this and the fact that Norway is less urbanized than Denmark and Sweden and thus Norwegians are likely to travel more by car, it is important that the amount of diesel and gasoline purchased is included as a variable in this study.

Ch.3 Overview of Case Studies and Historical Background of Countries as Environmental Actors

3:1 Similarities and Differences Of Case Studies

The historical, cultural, political and economic foundations of Denmark, Norway and Sweden are very similar and thus control for many different factors that might affect the cross-country analysis of environmental policy and performance. All three countries have unitary parliamentary democracies with constitutional monarchies as their form of government, making their political systems commonly conceived as fitting for “most similar system” comparisons (Bergman and Strøm 2011). This entails the executive power of each nation falling under their respective Prime Minister (Bergman and Strøm 2011). All three countries encompass the Nordic Model which includes free market capitalism with a “universalist” welfare state that aims at providing economic security for its citizens (Bergman and Strøm 2011). There is a strong aspect of income redistribution through this model and an egalitarian framework aimed at protecting the whole of society (Bergman and Strøm 2011). This is exemplified by public services such as free education and universal healthcare which aim to provide assistance to *all* citizens. In comparison to the size of their economies, the public sector of all three countries is relatively large and citizens have typically been very active in participating in their democratic systems (Bergman and Strøm 2011). When compared to other European countries, the Scandinavian countries tend to have more trust in their national parliaments and legal systems, and their conservative parties, or populist right parties, tend to be more moderate (Bergman and Strøm 2011).

Denmark, Norway and Sweden are among the wealthiest countries in the world with relatively high GDPs per capita. While Norway's GDP per capita is much higher than Denmark and Sweden's, it also has the smallest population of the three (Central Intelligence Agency 2016). Conversely, Sweden's total GDP is the highest, yet also has the largest population (see Table 2). All three countries are members of the Organisation for Economic Co-operation and Development (OECD) and European Economic Area (EEA), while only Denmark and Sweden are part of the European Union (EU) (Central Intelligence Agency 2016). There were two separate referendums in Norway regarding joining the European Union in 1994 and what was then the European Community in 1972, in which citizens voted to reject joining EU membership both times (Bergman and Strøm 2011). These countries are similar in terms of climate, although Denmark is much smaller thus making the differences in weather between different parts of the country less drastic than Northern Norway compared to Southern Norway (Central Intelligence Agency 2016). Denmark is also more urbanized and has a much denser population per square kilometer (World Bank 2016). Furthermore, it is important to note that although Sweden's territorial land area is much larger, there are very few inhabitants on the inland Western border and in fact 97% of Sweden is uninhabited (Swedish Institute 2015).

Table 2: Comparison chart of Denmark, Norway and Sweden

	Denmark	Norway	Sweden
Form of Government	Unitary parliamentary constitutional monarchy	Unitary parliamentary constitutional monarchy	Unitary parliamentary constitutional monarchy
Total GDP[1]	$252.5 billion	$343.1 billion	$444.7 billion
GDP Per Capita	$45,100	$67,300	$46,100
Population[2]	5,593,785	5,265,158	9,880,604
EU Member	Yes	No	Yes
Population Density (people per square KM of land area)[3]	134	14	24
Territorial Size	43,094 Sq Km[4]	323,802 Sq Km	450,295 Sq Km
% of Population Living in City with Population >250,000	28%	23%	22%
% of Urban Population	87.7%	80.5%	85.8%
Avg. Temperature in Respective Capitals	47.5 degrees F	45.5 degrees F	45.5 degrees F
First Phase Kyoto Protocol Target*	- 21%	+1%	+4%
Target Met	Yes	Yes	Yes

Data: CIA, World Bank

[1]Refers to purchasing power parity and is for 2013, numbers are in 2015 US dollars
[2]As of July 2016
[3] As of 2015
[4] Excludes Faroe Islands and Greenland
* As EU members, the target was -8%, both DK and SW met this target, the Kyoto Protocol targets will be discussed in more depth in the following sections.

3:2 Denmark: Environmental Policy History

Despite the challenges of reducing CO_2 emissions, Denmark, Sweden and Norway have all made notable efforts in this policy area and these countries are commonly considered to be environmental leaders. It is important to look at each country's environmental policy measures, the political tools they have used and how their efforts have been perceived at an international level to provide historical credence to the puzzling difference in recent CO_2 emission levels. I will discuss Denmark and Sweden's history first as they are more straightforward. Some of the policy instruments mentioned for these two countries will be elaborated on more in the section regarding Norway and when this is the case it will be noted.

Denmark has been a global leader in transitioning to a society free of fossil fuels while still maintaining a thriving economy. Interestingly, in "Denmark's Climate Policy Objectives and Achievements" report published by the Danish Ministry of the Environment in 2005 there is mention of the influence the Brundtland report, which was written by former Norwegian Prime Minister Gro Harlem Brundtland, had on Denmark (Danish Ministry of the Environment 2005).[3] The Brundtland report inspired Danish policymakers to develop policies that cross all sectors and thus considerable measures have been implemented (Danish Ministry of the Environment 2005). The initial focus starting in the early 1990s was primarily on a shift away from energy sources such as coal and oil towards renewable sources such as wind (Danish Ministry of the Environment 2005). In fact, Denmark has become a world leader in wind-powered energy and no other country in the world has a relatively larger wind power sector to this day (Moe 2015). According to the International Energy Agency, Denmark "engaged in what is probably the most ambitious support scheme for renewable energy technologies ever seen" (Moe 2015). Additionally, the Danish company Vestas was the world's largest wind power company from 1999 through 2011 (Moe 2015). Some may even argue that Denmark has what could be considered a "wind-industrial complex" (Moe 2015). Since a primary source of energy

[3] This will be elaborated on more in the forthcoming section in this chapter regarding Norway.

consumption in Denmark is to heat homes during the cold winters, an effort was made to cogenerate heating systems with renewable and non-renewable sources (Danish Ministry of the Environment 2005). Wind energy now makes up over 40% of the energy consumed in Denmark and is likely to only increase as the country shifts towards becoming completely fossil-fuel free (Moe 2015). Biomass also constitutes around 10% of energy use, which means approximately 50% of Danish energy production comes from renewables (Moe 2015). This is largely attributed to the 12% reduction in total greenhouse gas emissions seen from 1990 to 2003 (Danish Ministry of the Environment 2005). Denmark's GDP also increased by an average of 2% annually during this time period exemplifying that substantial shifts towards renewable energy systems are not only possible, but do not necessarily come at the cost of economic stagnation (Danish Ministry of the Environment 2005).

In addition to the energy needed to warm homes, it became apparent to Danish officials that the transportation sector, and especially the use of cars, was contributing significantly to emissions. In an attempt to address this issue, two tax reforms regarding car usage in Denmark were enacted which had a significant influence in reducing Danish CO_2 emissions specifically (Munk-Nielsen 2015). The first reform enacted in 1997 and the second ten years later in 2007 initiated a significant shift in the type of cars purchased in Denmark towards more diesel fueled and fuel-efficient cars (Munk-Nielsen 2015). These reforms gave rebates for "greener" cars and increased the fee for "dirty" cars; Danes responded very strongly to these tax incentives showing how effective national policy reforms can be (Munk-Nielsen 2015). This incentive helped shift transportation in Denmark to being more reliant on bicycle usage and today cycling accounts for 17% of all trips in Denmark and Danes on average cycle almost 600 miles per year (Cycling Embassy of Denmark 2016). A 2011 study by the European Cycling Federation found that if the EU cycling rate was as high as that of Denmark, emissions from the transportation sector could be reduced by as much as 25% (Walker 2011). Although granted other countries within the EU are not as urbanized and do not have an abundant area of flat terrain as Denmark does, this statistic still shows the impact that the high cycling rate and shift towards environmentally friendly manners of transportation in Denmark is having on emissions.

Although the European Union commitment under the Kyoto Protocol for the first phase between 2008 and 2012 was 8% reduction in emissions based on 1990 levels, Denmark set the aggressive target of reducing emissions by 21% during this time frame (National Auditing Agency of Denmark 2012). Denmark made this decision as part of its larger goal to completely phase out fossil fuels by 2050, a target they are on track to meet (Danish Ministry of Energy, Utilities and Climate 2016). However, Denmark fell short of meeting this 21% goal with a reduction of 14% by 2012, and used the European Union Emissions Trading Scheme (EU ETS) to purchase offsets to cover the additional amount so that "technically" the Kyoto Protocol target was met (ICIS 2013).[4] Despite Denmark's reliance on the EU ETS to meet its target, which is arguably not the most efficient way to reduce emissions, 14% reduction in emissions during this time period is significant and accomplishes nearly twice what was required of Denmark as an EU member. Denmark is expected to meet the 2020 Kyoto target set by the EU of 20% reduction based on 1990 levels (Danish Ministry of Energy, Utilities and Climate 2016).

[4] This will be elaborated on more in the forthcoming section in this chapter regarding Norway.

3:3 Sweden: Environmental Policy History

There are two primary characteristics of environmental policy in Sweden that can account for the steady decline in emissions the country has seen since the end of the 1970s: the integration between environmental policy and modernization, and the importance of protecting the environment as a recurrent theme in most areas of legislation, not just environmental legislation (Lönnroth 2010). Environmental concerns started appearing in political rhetoric in the European region in the early 1970s, before the EU was in place though the European Economic Community did exist (Lönnroth 2010). However, Sweden started taking measures to address environmental issues in the early 1960s and in 1967 was the first country in the world to establish an Environmental Protection Agency (Swedish Institute 2016). Environmental protection was regarded as a force for the modernization of Swedish industry as pollution was seen as the result of old, dirty and inefficient technology, and thus a movement away from industrialization (Lönnroth 2010). Notably, this early attitude was shared by both industry and trade unions which led to a consensus that environmental protection was a necessary component of becoming industrialized or "modern" (Lönnroth 2010).

To this day, although the Swedish Ministry of the Environment is the core of environmental protection, all other ministries are required by law to put the environment into consideration when implementing measures or policies (Swedish Institute 2016). This cross-sector collaboration to address environmental concerns, which started early on, has been key to keeping emissions low in Sweden. This is also a very different approach than in Norway, in which protecting the environment was seen as costly to industries and thus less strict policies were put in place early on. Granted, Sweden does not possess the abundant amount of oil reserves that Norway does. However, similar to Norway, Sweden can be considered a "pusher" state in terms of environmental policy. Although Sweden only accounts for 0.2% of total global emissions, it has been a leader in international climate negotiations (Swedish Institute 2016). Furthermore, Sweden is one of the most innovative countries in the world when it comes to technological advancements that are environmentally friendly (Swedish Institute 2016). Considerable investment in research and development for clean energy technologies has made Sweden not only a leader in environmental sustainability, but also has given Sweden an advantage in terms of integrating sustainable technology into Swedish society (Swedish Institute 2016).

Despite the continually low CO_2 emission levels in Sweden and the impact of cross-sector collaboration on environmental issues being noteworthy, there is one aspect to Sweden's energy profile that is concerning: the high reliance on nuclear energy. About 40% of energy production in Sweden is nuclear which has been a main energy source since the mid-1960s (World Nuclear Association 2017). There are currently nine operating nuclear power reactors in Sweden, while Denmark and Norway each have zero (World Nuclear Association 2017; OECD 2015; OECD 2001). After the Chernobyl catastrophe in 1986, which showed the world how dangerous nuclear energy production can be, the Swedish government began working on decommissioning nuclear energy but was quickly overturned by pressure from trade unions (World Nuclear Association 2017). Interestingly, it is not only trade unions that have kept nuclear energy as a major contributor to energy production, but public opinion has played a large role as well (World Nuclear Association 2017). Public support for continuing to develop nuclear power and using existing reactors in 2006 was 79% and 82% in 2008 (World Nuclear Association 2017). However, more recently support for nuclear power has shifted to around 60% of Swedes approving of nuclear energy production in 2013 (World Nuclear Association 2017). Most seem to believe that it is actually a beneficial method of energy production for the environment (World Nuclear Association 2017). However, the primary concerns regarding nuclear energy use are the possibility for another disaster such as Chernobyl, and the need to store nuclear waste. Sweden is currently storing the high-level waste from its nuclear energy consumption under water in an underground rock cavern (World Nuclear Association 2017). The concern with nuclear waste storage is similar to that of carbon capture and storage in that the waste could leak, causing irreversible and possibly devastating consequences (Madres 2011).[5] In 2015, a decision was made by the Swedish government to close four nuclear reactors by 2020, and a high tax has been implemented to discourage the use of nuclear energy while subsidies that are about three times higher are meant to encourage a lager reliance on renewable energy (World Nuclear Association 2017). However, the waste already accumulated and the increase that will occur until all nuclear reactors are closed will need to be dealt with for thousands of years (Madres 2011). This has the potential to end up harming the environment much more than a gradual release of CO_2 emissions would have (Madres 2011). Given the strong support by the public and trade unions, a shift to completely nuclear-free energy production in Sweden is not likely to occur soon.

[5] Carbon capture and storage will be elaborated on more in the forthcoming section in this chapter regarding Norway.

Despite Sweden's early, progressive attitude towards sustainable development, surprisingly the country did not make significant targets when signing and ratifying the first phase of the Kyoto Protocol. Despite being part of the European Union and thus being mandated to set a target of -8% in emissions between 2008-2012 based on 1990 levels, Sweden set a goal of +4% during that time period- a target that was approved by the EU (Swedish Ministry of the Environment 2014). However, the EU approved this with the understanding that Sweden had plans to phase out all nuclear power by 2010 (Swedish Ministry of the Environment 2014). This was quickly abandoned, although Sweden did remove two out of 12 nuclear reactors (Swedish Ministry of the Environment 2014). The primary reason Sweden had committed to such an insignificant target is that economic growth had been predicted to increase dramatically during this time (Swedish Ministry of the Environment 2014). This presumption was not incorrect as Sweden's economy grew 44% between 1990 and 2006, yet emissions declined by 12.7% during the same period (Swedish Ministry of the Environment 2014). Despite the prediction that economic growth would increase emissions, the Swedish Ministry of the Environment declared that emissions from housing and services had been reduced by over 50% during the same time period due to the use of cleaner energies being used to heat homes (Swedish Ministry of the Environment 2014). The Swedish government also credits this decline in emissions to the carbon tax implemented in 1995 (Swedish Ministry of the Environment 2014). Before the end of the first phase of the Kyoto Protocol in 2011, Sweden had reduced total emissions by 16% (Swedish Ministry of the Environment 2014). This demonstrated a similar story to that of Denmark: reducing CO_2 emissions does not have to come at the cost of a thriving economy.

Moving forward, Sweden has set a target to have no net greenhouse gas emissions by 2050 (Swedish Ministry of the Environment 2014). In an effort to achieve this long term goal, shorter term targets have been set: a 40% reduction of greenhouse gas emissions by 2020 compared to 1990 levels and to only have completely fossil fuel free vehicles by 2030 (Swedish Ministry of the Environment 2014). Under the Kyoto Protocol, Sweden is committed to reducing 20% by 2020 making their national target twice as high as what is required under Kyoto (Swedish Ministry of the Environment 2014). This larger 40% commitment was made under EU initiatives which aim to have total greenhouse gas emissions in the EU reduced by at least 80% below 1990 levels by 2050 (Swedish Ministry of the Environment 2014). A study by the Swedish National Institute of Economic Research found that there is a strong chance Sweden will meet its 2050 goal due to economic developments and political incentives (Swedish Institute 2016).

3:4 Norway: Environmental Policy History

Norway in particular has been considered a "pusher" state in terms of international environmental negotiations (Skjærseth 2004). *Our Common Future*, also known as the Brundtland Report, was published by the World Commission on Environment and Development (WCED) in 1987 when it was led by the former Norwegian Prime Minister Gro Harlem Brundtland (Skjærseth 2004). This report had global influence and put environmental issues at the forefront of the Norwegian political agenda. It addressed the seriousness of environmental concerns and stated that sustainable development and international cooperation were necessary; that Norway wanted to step up to do its part (Skjærseth 2004). The next year White Paper 46, *Report to the Storting No 46 (1988-89),* *Environment and Development: Programme for Norway's Follow-Up of the Report of the World Commission on Environment and Development* was released by the Norwegian Ministry of the Environment in which this notion was reinforced (Clayton 2013). White Paper 46 projected there would be a 28% increase in Norwegian emissions from 1989 - 2000 if no new measures were adopted (Skjærseth 2004). It started with a letter from Prime Minister Brundtland to all cabinet ministers asking them to examine *Our Common Future* and analyze what Norway could do to stabilize emissions (Clayton 2013). Additionally, all staff of the secretariat responsible for White Paper provided detailed information about the contents of the Brundtland report to all senior civil servants in all ministries (Clayton 2013). Each ministry then was requested to produce potential actions and policies which were reviewed and discussed by the secretariat (Clayton 2013). White Paper 46 was extremely important because it contained both problems concerning the environment and potential policies to mitigate such issues in a single document (Clayton 2013). Additionally, it set forth the environmental responsibilities of each individual sector of government in order to make it clear what was possible and expected of each sector (Clayton 2013). Much of the principles laid out in White Paper 46 still work as a foundation for Norwegian Environmental policy today and it is plausible that the impact of the Brundtland report, White Paper 46 and consequently the influence of Prime Minister Brundtland could have influenced the drop in Norwegian emissions in the late 1980s and following stabilization until around 1996 (Skjærseth 2004).

With a general consensus across party lines to address environmental issues, the Norwegian Parliament came up with a national strategy to follow through with the mandates laid out in *Our Common Future* and the White Paper that followed (Skjærseth

2004). At this time, in 1989, Prime Minister Brundtland was actually harshly condemned for proposing a target considered insufficient compared to the seriousness of the issue as explained in the Brundtland report (Skjærseth 2004). What resulted were debates depicted as a "green beauty contest" in which different parties in the Norwegian government attempted to propose the most ambitious climate measures possible since protecting the environment had become of utmost concern to politicians at the time (Skjærseth 2004). The final agreed upon goal was to stabilize CO_2 emissions by 2000, based on 1989 levels (Skjærseth 2004). However this was a preliminary target that was to be re-evaluated as technology advanced and compared to international climate change agreements as they developed (Skjærseth 2004).

Unfortunately by the mid-1990s it was apparent that this goal was actually far too ambitious, despite earlier criticism when it was first established that it was not strict enough. At this point there were no international, legally binding climate treaties and Norwegian authorities were resistant to imposing measures that would impose significant costs on industry and trade, an issue that is still apparent today (Skjærseth 2004). Officially, the target to stabilize emissions by 2000 was in place until the end of 1997 despite Norway's observed increase in emissions after 1995 (Skjærseth 2004).

In 1997, national commitments were made based on agreements produced in the Kyoto Protocol (Skjærseth 2004). During the first half of the 1990s scientific research advanced and the necessity to reduce all types of greenhouse gas emissions became evident (Skjærseth 2004). The Kyoto Protocol covers CO_2 and five other greenhouse gases: methane, nitrous oxide, perfluorocarbons, sulfur hexafluoride and hydrofluorocarbons (Skjærseth 2004). This resulted in a less ambitious CO_2 target due to the fact it gave countries the ability to choose which greenhouse gas emissions to reduce; it did not require reductions in CO_2 specifically. However, as previously mentioned in the section regarding CO_2 emissions, the present-day scientific consensus is that reduction in CO_2 emissions is imperative to mitigating the effects of climate change and should be the focus of current environmental efforts.

Norway's primary policy instrument for reaching its Kyoto target of increasing CO_2 emissions by only 1% between 2008-2012 (phase 1) based on 1990 levels was joining the cap and trade program of the European Union Emissions Trading Scheme (EU ETS) and by implementing a carbon tax (Climate Action Tracker 2016). However, there are major issues with both of these policy solutions. Currently, the Norwegian carbon tax covers roughly 45% of emissions while the remainder fall under the European Union Emissions Trading Scheme, which Norway joined in 2008 (International Emissions Trading Association 2015). Among the most pertinent issues regarding the carbon tax is that it is considered to be a deductible operating cost for petroleum activities which significantly reduces the amount actually paid by oil companies (International Energy Agency 2013). The objective of the carbon tax is to incentivize companies, especially those in the oil and natural gas industry, to shift towards more sustainable methods of production or extraction, but because a portion of the tax can be written off it weakens this influence. The Norwegian Ministry of the Environment asserted in "Norway's Fifth National Communication Under the Framework Convention on Climate Change" in December 2009, that the carbon tax has been the most effective tool in reducing emissions produced by petroleum activities and that although emissions have increased, they would have seen a much larger increase had the carbon tax not been implemented (Norwegian Ministry of the Environment 2009).

However, it has been estimated that from 1990-1999 carbon taxes only contributed to 2% of the 14% reduction found compared to a business as usual scenario (Bruvoll and Larsen 2002).

Additionally, the EU Emissions Trading Scheme has been subject to much criticism and considered inefficient for a multitude of reasons. The idea behind the EU ETS is to put a cap on total emissions allowed from participating countries and therefore the companies within those countries. Emissions allowances are given to each company and all allowances when added up will equal the cap that has been set (Fairley 2009). Each allowance is equal to one ton of CO_2 and companies can trade their allowances (Fairley 2009). It is argued that there has been an over-allocation of emissions allowances and that the price of purchasing a permit that allows industries to pollute is far too low and thus does not incentivize a change in production methods (Laing et al 2014). Furthermore, the EU ETS rules allow for "offsets" to a company's emissions if they invest in projects aimed at reducing greenhouse gas emissions in developing countries, a method Norwegian companies have relied on heavily (Laing et al 2014). This makes it possible for companies that are large emitters to essentially "buy their way out" of reducing the actual amount of domestic emissions laid out under the EU ETS. They simply invest money in a developing country's carbon reduction project and thus are allowed to emit more while still technically following the EU ETS requirements. There is a fear that these projects are too small to make substantial differences and that the administration necessary to oversee the projects may be insufficient (Laing et al 2014).[6] It is also important to acknowledge that under current

[6] There has also been an issue of businesses charging consumers for costs related to the EU ETS that were never actually incurred in the first place, resulting in an increase of profit at

legislation if the price of allowances through the EU ETS increase over time, the Norwegian carbon tax will be lowered relatively so that the overall carbon price will remain roughly the same (Norwegian Ministry of Petroleum and Energy 2013).

The only way Norway was able to meet its Kyoto Protocol target for the first phase was through the purchase of offsets, as the writing of the protocol allowed for such. Norway was to reduce greenhouse gas emissions to no more than 1% above 1990 levels for 2008-2012, however in 2012 Norway's levels were 5.1% higher than 1990 levels (Environmental Defense Fund and International Emissions Trading Association 2013). As a solution to meeting the target, the Norwegian government purchased $21.5 million worth of offsets from the United Nations (Environmental Defense Fund and International Emissions Trading Association 2013). This is how Norway is considered to have met its first Kyoto target, while seeing a large increase in emissions since 1995. It should also be noted that Norway's Kyoto target during phase one was far less ambitious than the European Union's, which had a goal of reducing emissions by 8% based on 1990 levels (Skjærseth 2004). This is partially due to the rapid increase of emissions in Norway seen in the late 1990s, and the failure to meet national goals after the Brundtland report was released (Skjærseth 2004).

Another way Norway is looking to reduce CO_2 emissions in the future is through Carbon Capture and Storage (CCS), a method that Norway has been researching for approximately 20 years (Bergsli 2017). When the CO_2 tax was implemented in 1991, it prompted CO_2 storage projects on the continental shelf (Bergsli 2017). CCS hasn't been

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the expense of consumers (Laing et al 2014). This is not directly related to the inefficiency in reducing emissions but highlights another flaw of the EU ETS.

largely implemented yet but is the primary method considered for future reductions in emissions (Bergsli 2017). Norway is the only country in Europe that has already developed two CCS pilot projects, which are operated by Norway's largest oil company, Statoil (Bergsli 2017). Additionally, the world's largest CCS test facility is operated by Gassnova, owned by the Norwegian Ministry of Petroleum and Energy, as part of a joint venture between the Norwegian government and oil companies Statoil, Shell and Sasol (Bergsli 2017). The government is hoping to have one full-scale CCS demonstration project by 2020 (Bergsli 2017). As the name suggests, CCS attempts to capture CO_2 before it is released into the atmosphere and store it underground; the pilot projects in Norway have been storing it in sub-seabed formations (Bergsli 2017). Although the European Union funded project, ECO2, found that these two pilot projects in Norway would have a "small" impact on the organisms living in the seabed if there was a leak, many large scale projects have been discontinued all over the world including in Norway, the UK and the US due to the risk of leakage (ECO_2 2017; Greenpeace 2016). In fact, Norway's initial full-scale CCS project, Mongstad, was cancelled in 2013 as it was found to be "too risky" (Forbes 2013). Additionally, scientists found huge fractures in one of the Norwegian pilot program's storage areas, making it extremely likely that it will eventually leak (Monastersky 2013). What makes CCS at a full scale precarious is that it only works if the CO_2 stays underground permanently, and if it leaks there will be a massive amount of CO_2 released back into the atmosphere all at once which causes devastating effects. For example, an oil company in the United States experienced a massive leak from storing CO_2 underground and the large amount of CO_2 released at once suffocated the surrounding wildlife (Greenpeace 2016). Additionally, CCS is extremely expensive to implement as it requires new technology to not only capture and store the CO_2, but also to monitor CO_2 once it has been buried (Greenpeace 2016). This method for reducing emissions seems unlikely to work efficiently at a large scale domestically, and especially not at a global one. It is understandable that oil companies, like Statoil, would like to implement such a system in order to continue production while reducing emissions (at least for a while), yet it is short sighted and given the cost, it seems that a shift towards renewable energy would be more beneficial in the long term.

Norway has primarily maintained its status as a global environmental leader through its financial contributions to developing countries (Eckersley 2015). In Norway, poverty and climate change has been seen as interrelated issues to tackle (Eckersley 2015). Norway has thus linked its international responsibility to address environmental issues to its priority of reducing inequality around the world through funding low-carbon development and forest protection in developing countries (Eckersley 2015). Norwegians have recognized that they are fortunate to have attained such wealth in recent decades and find it necessary to promote poorer countries' right to develop by helping them "jump over the most polluting stages in the economic development." (Eckersley 2015). This sort of mentality undoubtedly deserves praise, as climate change is a collective action issue and its connection to poverty should not be overlooked. However, it seems somewhat hypocritical for a country whose CO_2 emissions are seeing a dramatic increase to promote low-carbon projects abroad while continuing to miss targets set at home. As Nina Jensen, the head of the World Wildlife Fund in Norway stated, "We are telling everybody else what they should be doing but we are not doing it ourselves." Arild Hermstad, the head of the Future in Our

Hands, Norway's leading environmental lobby group added, "We are frustrated most of the time because jobs go before the environment" (Milne 2016).

Despite the continued increase in emissions, the Norwegian government has signed on to extremely ambitious emissions reduction goals for the future. In June 2016, Norway committed to climate neutrality by 2030 and, although it has laid out a plan that primarily relies on emissions trading through the EU ETS, Climate and Energy Minister Vidar Helgesen declared that Norway "must be prepared to take the majority of cuts at home" (Climate Action Tracker 2016). Such acknowledgement is very important yet will require drastic changes. Norway has also ratified and signed the Paris Agreement and a bilateral agreement with the European Union to reduce emissions by at least 40% based on 1990 levels by 2030 (Climate Action Tracker 2016). This is the highest target for any country in the European Union (Climate Action Tracker 2016). Additionally, under Norway's Copenhagen Summit pledge in 2009 and second phase of the Kyoto Protocol target, which is from 2013-2020, Norway has committed to 30% reduction by 2020 (Climate Action Tracker 2016). However, under current policy mechanisms, emissions are predicted to continue to increase according to climate specialists, illustrating the necessity of policy reforms (Climate Action Tracker 2016).

In order to understand more thoroughly where these policy reforms should be focused, it is important to look at Norway's Ministry of Petroleum and Energy, and more specifically at the policies that oil and gas companies drilling in Norway are mandated to follow. The fact that Norway even has a Ministry of Petroleum and Energy (and not just a Ministry of Energy or a Ministry of Climate and Energy like Denmark) suggests the petroleum industry not only is an integral part of the Norwegian economy, but has political influence as well. In the early 1980s there were several attempts to limit the influence that Statoil had on this Ministry, resulting in friction as Statoil's chairman's attempted to sidestep the ministry (Moe 2015). However, from the 1990s onward Statoil became the center of Norwegian energy policy (Moe 2015). Former Prime Minister Kåre Willoch (1981-86) described Statoil as a "state within the state, pushing projects on its own behalf, at the expense of the state, where projects otherwise not economically viable could be forced through parliament with the help of its political, regional and industrial allies" (Moe 2015). He further argued that the Norwegian petroleum sector, and principally Statoil, had used the state to fund projects that were in its own best interest, not the nation's (Moe 2015). Unfortunately, this bias within the Ministry of Petroleum and Energy in favor of the petroleum industry has only gotten worse over time. Both Norwegian and foreign petroleum companies have increasingly worked as a united force (Engen, Langhelle and Bratvold 2012). The companies as well as the suppliers, consultants, stock traders and public institutions that work closely with the industry have turned into a complex network that dominates Norwegian political priorities (Engen, Langhelle and Bratvold 2012). As Ole Andreas Engen, Oluf Langhelle and Reidar Bratvold describe it in their book *Beyond the Resource Curse*, "The Norwegian petroleum industry constitutes power elite that seeks and possesses political influence on a variety of the state's policy decisions, especially those in the environmental sphere." They add that given this, the Norwegian petroleum industry is not longer an "unambiguous force for prosperity and wealth but a possible threat to a more sustainable future" (Engen, Langhelle and Bratvold 2012).

Despite this the Ministry of Petroleum and Energy continues to state its commitment to the environment and has declared, like the Norwegian Ministry of Climate and Environment, that it has relied significantly on the carbon tax and EU ETS to offset emissions from oil and gas production (Norwegian Ministry of Petroleum and Energy 2013). However, there are three additional acts specifically pertaining to this industry: The Sales Tax Act, the Pollution Control Act and The Petroleum Act (Norwegian Ministry of Petroleum and Energy 2013). The Sales Tax Act, or Petroleum Taxation Act, essentially mandates that there will be a tax incurred for exploration and extraction of subsea petroleum deposits (Regjeringen 2016). The Pollution Control Act of 1981 makes no specific mention of petroleum activities (although it does mention activities on the continental shelf), but generally states that Norwegian individuals and companies must make an effort to prevent an increase in pollution and any activities that are expected to cause a large increase in pollution must first attain a permit that denotes an environmental impact assessment has been made (Regjeringen 2003). Interestingly, a recent comprehensive report from the Ministry of Petroleum and Energy entitled "Facts 2013- The Norwegian Petroleum Sector", mentions these three acts yet goes into no detail regarding what they entail or who is responsible for administering them (although it does go into some detail for the EU ETS and Carbon Tax) (Norwegian Ministry of Petroleum and Energy 2013). After looking further into this, I found that the Petroleum Act of 1996 provides the legal basis for resource management, which includes the licensing system or providing permits for petroleum exploration and activity (Norsk Petroleum 2017). The licensing system gives companies the rights to engage in petroleum activities, but companies must first declare *where* activities are planned and this area must be approved before licenses are issued (Norsk Petroleum 2017). The Pollution Control Act requires that the area companies propose is assessed and that an evaluation of the possible environmental impacts is undertaken (Regjeringen 2003). What is remarkable is that the Ministry of Petroleum and Energy makes this environmental assessment, not the Ministry of Climate and Environment (Norsk Petroleum 2017). It is also noteworthy that the year of 1996, when this act was put in place, coincides almost exactly with when the recent rise in emissions in Norway was observed.

It is plausible that the Petroleum Act of 1996 has played a crucial role in Norway's recent increase in emissions. The Ministry of Petroleum and Energy, a Ministry known to be influenced by Statoil, conducts the assessment on how much environmental damage will be incurred by expanding oil production, and also decides how many oil companies can be in operation and where they can drill through issuance of licenses (Norwegian Ministry of Petroleum and Energy 2013; Norsk Petroleum 2017). Additionally, it seems the Ministry of Petroleum has not been especially conservative with their issuance of these licenses. In the 2016 licensing round 29 of 33 companies who applied for production licenses were granted them (Regjeringen 2017). A total of 56 production licenses were awarded as a company can attain more than one; this is more than double the number issued during the previous licensing round which awarded only 24 (Regjeringen 2017). The Ministry of Petroleum and Energy is likely to have a biased point of view when deciding between increased oil and natural gas production which increases revenue incurred for both the Norwegian government and large oil companies like Statoil, and the environmental impact that results from it. This is especially probable since The Ministry of Petroleum and Energy makes note of the petroleum industry being "by far the largest and most important industry" (Regjeringen 2017). In May 2016, it was also announced that for the first time in more than 20 years the Ministry is opening new acreage for oil and natural gas exploration in the Arctic Barents Sea (Regjeringen 2016). This seems contradictory to the existing international environmental agreements Norway has signed, especially given the irony that ten days after this announcement Norway was the first developed country in the world to ratify the Paris Agreement (Greenpeace 2016).

Ch.4 Research Design: Data Sources, Operationalization of Hypotheses, Methods of Analysis and Regressions

4:1 Operationalization of Hypotheses and Data Sources

In this section I will explain my research design which includes the operationalization of my independent and dependent variables, data sources and presentation of linear regression models that have been estimated using the statistical analysis software STATA. First I start with the operationalization of each variable and the data sources and afterwards present the regression models.

Dependent Variable

The dependent variable is carbon dioxide (CO_2) emissions per capita, measured in metric tons. The data source for this variable is the World Bank in which all numbers are from the Carbon Dioxide Information Analysis Center (CDIAC), which has served as the primary climate change data and information analysis center for the United States Department of Energy since 1982 (Carbon Dioxide Information Analysis Center 2014). After contacting the director of CDIAC, Thomas A. Boden, I was informed that the CO_2 levels are calculated based on numbers provided by the United Nations who in turn get the numbers directly from national governments. It is calculated from three elements: 1) the amount of fuel (e.g., coal, natural gas, jet fuel) burned, 2) the efficiency of the combustion or oxidation rate, and 3) the amount of carbon in the hydrocarbon fuel. Although it may seem odd that emissions are not measured directly, it is actually common for them to be calculated based on these numbers and rare that they are measured. The Intergovernmental Panel on Climate Change (IPCC) published multiple guides on how to estimate CO_2 emissions with this calculation, and countries use it as part of the United

Nations Framework Convention on Climate Change (UNFCCC) in attempt to create consistency across countries (The Naked Scientists Foundation 2010). Scientists sponsored by University of Cambridge estimate that for European countries the margin of error likely for calculating CO_2 emissions based on these elements is no more than plus or minus 5% (The Naked Scientists Foundation 2010). This data was collected beginning in 1960, however due to limited data for most independent variables, the regressions that will be presented do not go back this far.

Independent Variables- Production Economy

Oil and Natural Gas Production:

Oil and natural gas production is measured by thousands of barrels per day (bbl/d) of oil and natural gas produced annually. The International Human Resources Development Corporation (IHRDC), which has been a world leader in competency development for the oil and gas industry for over 40 years, states that bbl/d is the standard measurement or volume unit for oil and gas production (IHRDC 2014; IHRDC 2017). This method has been used since the 1860's when United States producers used wooden barrels to store and transport petroleum (IHRDC 2014). The data source for this variable is the United States Energy Information Administration (EIA) and this information was collected back to 1980.

Independent Variables- Consumption Economy

Gas and Diesel Purchased/Sales:

Gas and diesel sales in each country are measured by millions of liters sold annually. This information was not available for all three countries from a single source and therefore had to be collected by each individual country's energy statistic department. I contacted Energimyndigheten (translates to Energy Agency) in Sweden, Division for

Energy and Environment Statistics, Department of National Accounts and Industry Statistics in Norway and Statistics Denmark. The information was either sent directly to me[7] or the link to the information I needed was emailed to me in order to assure I was collecting the proper data as the only information in English was from Norway. The information pertaining to Denmark was translated by the Senior Advisor I contacted in Statistics Denmark, and she additionally guided me on how to convert the numbers so they would be comparable to Norway and Sweden since it is measured by ton/M^3 instead of liters in Denmark.[8] Although this information is available back to 1970 for Denmark and Sweden, it is unfortunately only available back to 1995 for Norway. Therefore, regressions including this information will only go back until 1995.

Population Density:

Population density is measured by people per square kilometer of land area, and the data comes from the World Bank. It should be noted that this variable is going to be closely related to Denmark because it is the most urbanized and therefore more densely populated, but also remains fairly constant for all three countries across time. The data goes back to1960.

GDP/Capita:

GDP per capita is measured by gross domestic product divided by total population for each country. It is in current United States dollars and the data comes from the World Bank. GDP per capita increases over time for all three countries but increases by a much

[7] This information was not available online for Sweden so the data set was emailed to me directly and translated by a worker in the analysis department of Energimyndigheten.
[8] Ton/M^3 * 1000 = liters

larger amount for Norway, which should be taken into consideration. This data goes back to 1960.

Independent Variables- Domestic Politics

Prime Minister and Ministries of Environment:

This is measured using manifesto data from each party that was leading the respective environmental ministries and the party the Prime Minister belonged to in each country. It is measured by using the percent of the parties' electoral manifesto dedicated to the environment and progressive environmental policy. In years in which there was a change in party, the manifesto data for the incumbent party was used to recognize the shift in government. The data is from the Manifesto Project which is funded by the German Science Foundation and was collected back to 1976.There are two primary ways the salience of environmental issues and policy positions of different parties in government could be measured: manifesto data or expert survey data (Laver 2014). I chose to use the former because I believe it is important to know what the parties themselves are saying in order to more thoroughly understand their attitudes towards the environment and to see if they are acting on the rhetoric in their manifestos. Additionally, this seemed like a more effective way to measure across three different countries as the expert survey data likely would have three different experts analyzing each country which could lead to inconsistencies. However, it should be noted that there is also a downfall to using manifesto data in that a party mentioning the environment does not necessarily mean they will act on this rhetoric. Given the high public concern for the environment seen in the Scandinavian countries, it is possible that rhetoric regarding protecting the environment could be used to gain votes and not really be a salient issue to the party compared to other issues.

Being that Norway has a Ministry of Petroleum, while Denmark and Sweden do not, the manifesto data for this ministry could not be used in regressions involving all three countries however will be included in regressions for Norway only.

Independent Variables- International Politics

EU Policies:

The European Union has created legislation that has established more than 130 different environmental targets and objectives to meet between 2010 and 2050 alone, 63 of which are legally binding (European Environment Agency 2017). Given this large number, it would be nearly impossible to know whether or not this is influencing Denmark and Sweden without looking at legislation on a monthly basis and I therefore chose to instead look at major shifts in EU (and European Community) governance itself and the relationship to EU/European Community environmental legislation. I chose five major treaties based on a study by Henrik Selin and Stacy D. VanDeveer: 1) *The Single European Act of 1986* (entered into force in 1987) which created the European Commission, introduced Council qualified majority voting, contained articles officially denoting environmental issues as a Community task as this was prior to the official establishment of the EU and increased the role of Parliament in environmental policy- making through cooperation the Council; 2) *The Treaty on the European Union 1992* (also known as the Maastricht Treaty, entered into force in 1993) which officially created the European Union, extended Council qualified majority voting to environmental articles and replaced cooperation procedure between the Parliament and Council with co-decision procedure; 3)

The Treaty of Amsterdam 1997 (entered into force in 1999) which gave Parliament more authority by expanding co-decision procedure to more environmental areas and officially made sustainable development a core EU goal and strengthened commitments to environmental policy; 4) *The Treaty of Nice 2000* (entered into force in 2003) which adjusted Council qualified majority voting to raise the necessary number of votes and continued to stress sustainable development as a core objective for the European Union; and finally 5) *The Treaty of Lisbon 2007* (entered into force in 2009) which established environmental issues as a shared competence between the branches of the EU, changed Council qualified majority voting to a double majority system and established the legislative procedure for environmental policy-making for the Council and Parliament (Selin and VanDeveer, 2015). The years when these treaties went into force where coded for all five treaties for Denmark, the last three for Sweden (as it was not part of the European Community or European Union until 1995), and not at all for Norway since it has never been a European Community or European Union member.

4:2 Presentation of Regressions

Before presenting the results of the estimated regressions using the aforementioned variables, some important factors must be taken into consideration regarding data limitations. After running several regressions with results that were inconsistent, I found that this is an issue that is extremely difficult to answer solely using statistical analyses. Therefore I cannot rely solely on quantitative variables to explain Norway's rising CO_2 emissions. Furthermore, due to data availability some of the sample sizes and datasets are very small and therefore make it difficult to make concrete conclusions. There is a large amount of collinearity between certain independent variables and with only three countries there are some variables that are strongly correlated with certain countries. It is important to be transparent about this and that much more weight should be put on the qualitative analysis of this issue than the regressions that will be presented. Some conclusions can be made based of the regressions run but they must be taken with a grain of salt so to speak.

A group of time-series panel-specific multi-variate linear regressions that control for heteroskedasticity and first order auto-correlation[9] will be presented in which at first all independent variables are included and subsequent regressions remove the variables found to be insignificant until the last regression only has variables that are statistically significant. A significant correlation occurs when the Z score is higher than 1.65. When the Z score shows a negative correlation that means that with an increase in the independent variables there will be a decrease in the dependent variable, or in this case CO_2 emissions. These regressions do not include a control for the uniqueness of each country or country fixed effects; this is because it is important to see the effect of the independent variables regardless of which country they relate to. However, again this can be seen as a limitation due to the fact there are of course unique factors in each country that will affect their CO_2 levels. A regression will also be presented that removes observations for both Demark and Sweden and thus is only applicable to Norway, which looks solely at the domestic political variables, oil production and GDP/capita. The number of observations included in this regression are even smaller and therefore make the results even less concrete. However, being that the aim of this thesis is to specifically discover the factors contributing to

[9] This controls for the effects of the previous year to the next.

Norway's increasing emissions, I find it important to look at Norway by itself in addition to all three Scandinavian countries.

First, Table 3 contains a correlation matrix of all independent variables. A correlation of .7 or higher signifies a risk of collinearity and therefore the gas production and oil production variables were not included in the same regression models. I chose to present the regressions including oil production instead of gas production because this is more likely to increase CO_2 emissions, especially over time as companies must drill even deeper into the ground to extract oil (Gavenas, Rosendahl and Skjerpen 2015). However, I assume that where there is a statistically significant correlation between oil production and the dependent variable, it would also be true for gas production due to their high collinearity. [10]

Table 4 shows the results of the first regression which includes all independent variables presented in Table 3 except gas production. Due to diesel and gas sales being included, this data only goes back until 1995 leading to a very small number of observations. However, only diesel sales, population density and GDP per capita are found to be statistically significant. Being that the gas sales variable has the lowest Z score, Table 5 runs the same regression but without this variable. Table 5 finds oil production, GDP per capita, diesel sales and population density to be significantly correlated. Table 6 removes the EU policies variable as it was the variable with the lowest Z score in Table 3. Table 7 removes the Prime Minister manifesto data variable due to its insignificance, and finally, Table 8 removes Ministry of Environment manifesto data and presents the only variables

[10] Regression models were estimated substituting gasoline production for oil production and the statistical significance was the same.

found to be statistically significant: oil production, GDP per capita, population density and diesel sales. The correlation between diesel sales and CO_2 emissions is negative which means an increase in diesel sales leads to a decrease in CO_2 emissions, whereas the rest of the correlations are positive.

As previously mentioned, a regression with the domestic political factors of Norway and oil production (as it is a factor of interest and much more relevant to Norway specifically) is also presented in Table 9. This also includes GDP per capita, as it is another variable likely to be relatively influential to Norway. Thus the independent variables are GDP per capita, Oil production, Prime Minister, Ministry of Petroleum and Energy and Ministry of Environment manifesto data as seen in Table 9. Since this regression does not include gas and diesel sales, it goes back to 1976. Population density was not included as it is not as relevant to control for when looking at Norway by itself. Oil production, Prime Minister manifesto data and GDP per capita are found to be statistically significant. Additionally, several additional regressions with a variation of included independent variables were estimated for Norway by itself and every one found Prime Minister data to be significantly correlated. It is interesting that the Ministry of Petroleum is not found to be statistically significant, but this may be because 17 out of 34 of the observations are the same as the Prime Minister variable due to Labour party led governments often being single party. When the Prime Minister and cabinet ministers belong to the same party, the manifesto data will be identical for those years. Again, it should be noted that these regressions have a very small number of observations and thus their accuracy is likely to be error-prone. For example, the coefficient for the oil production Z score is negative, meaning this regression is suggesting an increase in oil production leads to a decrease in emissions.

This is very unlikely and further emphasizes the difficulty of using statistical analysis to resolve this issue and that there is a great deal of further quantitative research to be done on this topic.

Table 3: **Correlation Matrix of Independent Variables**

	OilPro~n	GasPro~n	GasSales	Diesel~s	PrimeM~r	Minist~t	EUPoli~s	GDPCap	Popula~y
OilProduct~n	1.0000								
GasProduct~n	0.8161	1.0000							
GasSales	-0.6560	-0.6489	1.0000						
DieselSales	-0.3880	-0.0555	0.1701	1.0000					
PrimeMinis~r	0.2177	0.2186	-0.3571	0.3767	1.0000				
MinistryEn~t	0.1629	0.2939	-0.1629	0.5898	0.6510	1.0000			
EUPolicies	-0.1798	-0.1818	0.1704	-0.1330	-0.2168	-0.2120	1.0000		
GDPCap	0.2514	0.6705	-0.5463	0.5635	0.4019	0.5007	-0.2044	1.0000	
Population~y	-0.4593	-0.5243	-0.2063	-0.1290	-0.0934	-0.4197	0.1041	-0.1722	1.0000

Table 4: **Regression with all independent variables (IVs)**

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic with cross-sectional correlation
Correlation:   panel-specific AR(1)

Estimated covariances      =         6          Number of obs      =        57
Estimated autocorrelations =         3          Number of groups   =         3
Estimated coefficients     =         9          Time periods       =        19
                                                Wald chi2(8)       =    107.38
                                                Prob > chi2        =    0.0000
```

Emissions	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
OilProduction	.0006047	.0005221	1.16	0.247	-.0004185	.0016279
GDPCap	.0000673	.0000188	3.59	0.000	.0000305	.000104
PopulationD~y	.021339	.01051	2.03	0.042	.0007398	.0419382
GasSales	-.0000371	.0004775	-0.08	0.938	-.0009729	.0008988
DieselSales	-.0011181	.0004612	-2.42	0.015	-.002022	-.0002142
PrimeMinister	.0608549	.0815306	0.75	0.455	-.0989422	.2206519
MinistryEnv~t	-.0458081	.0444343	-1.03	0.303	-.1328978	.0412815
EUPolicies	-.0661207	.2998239	-0.22	0.825	-.6537647	.5215233
_cons	6.288812	3.362716	1.87	0.061	-.3019908	12.87962

Table 5: Regression with all IVs except Gas Sales

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic with cross-sectional correlation
Correlation:   panel-specific AR(1)

Estimated covariances      =         6          Number of obs      =        57
Estimated autocorrelations =         3          Number of groups   =         3
Estimated coefficients     =         8          Time periods       =        19
                                                Wald chi2(7)       =    133.50
                                                Prob > chi2        =    0.0000
```

Emissions	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
OilProduction	.0006142	.0002538	2.42	0.016	.0001167	.0011116
GDPCap	.0000695	.0000126	5.51	0.000	.0000448	.0000942
PopulationDensity	.0212852	.0056629	3.76	0.000	.0101861	.0323842
DieselSales	-.0011812	.0004369	-2.70	0.007	-.0020375	-.0003249
PrimeMinister	.0687215	.0814671	0.84	0.399	-.0909512	.2283941
MinistryEnvironment	-.0545956	.0408194	-1.34	0.181	-.1346002	.0254091
EUPolicies	-.0670528	.2811479	-0.24	0.811	-.6180927	.483987
_cons	6.232593	.988256	6.31	0.000	4.295647	8.16954

Table 6: Regression with all IVs except Gas Sales & EU Policies

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic with cross-sectional correlation
Correlation:   panel-specific AR(1)

Estimated covariances      =         6          Number of obs      =        57
Estimated autocorrelations =         3          Number of groups   =         3
Estimated coefficients     =         7          Time periods       =        19
                                                Wald chi2(6)       =    124.11
                                                Prob > chi2        =    0.0000
```

Emissions	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
OilProduction	.0006064	.0002563	2.37	0.018	.000104	.0011088
GDPCap	.0000701	.0000127	5.52	0.000	.0000452	.000095
PopulationDensity	.0213082	.005716	3.73	0.000	.0101051	.0325113
DieselSales	-.0011936	.0004437	-2.69	0.007	-.0020632	-.000324
PrimeMinister	.0687601	.0815413	0.84	0.399	-.0910578	.2285781
MinistryEnvironment	-.0513287	.0413394	-1.24	0.214	-.1323524	.0296949
_cons	6.213713	1.017779	6.11	0.000	4.218903	8.208524

Table 7: Regression with all IVs except EU Policies, Gas Sales & Prime Minister Manifesto Data

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic with cross-sectional correlation
Correlation:   panel-specific AR(1)

Estimated covariances      =         6          Number of obs      =        57
Estimated autocorrelations =         3          Number of groups   =         3
Estimated coefficients     =         6          Time periods       =        19
                                                Wald chi2(5)       =    119.98
                                                Prob > chi2        =    0.0000
```

Emissions	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
OilProduction	.0006922	.0002383	2.90	0.004	.000225	.0011593
GDPCap	.0000681	.0000126	5.39	0.000	.0000434	.0000929
PopulationDensity	.0228532	.0054458	4.20	0.000	.0121797	.0335267
DieselSales	-.0010966	.0004313	-2.54	0.011	-.001942	-.0002512
MinistryEnvironment	-.0299538	.033648	-0.89	0.373	-.0959027	.0359952
_cons	6.122329	1.017377	6.02	0.000	4.128307	8.116351

Table 8: Regression with all statistically significant IVs

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic with cross-sectional correlation
Correlation:   panel-specific AR(1)

Estimated covariances      =         6          Number of obs      =        57
Estimated autocorrelations =         3          Number of groups   =         3
Estimated coefficients     =         5          Time periods       =        19
                                                Wald chi2(4)       =    123.84
                                                Prob > chi2        =    0.0000
```

Emissions	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
OilProduction	.0007169	.0002221	3.23	0.001	.0002816	.0011521
GDPCap	.0000645	.0000125	5.17	0.000	.0000401	.0000889
PopulationDensity	.0244825	.0055054	4.45	0.000	.0136922	.0352728
DieselSales	-.0011041	.0003513	-3.14	0.002	-.0017926	-.0004156
_cons	5.957651	.9070186	6.57	0.000	4.179927	7.735374

Table 9: **Regression with domestic political factors, oil production and GDP for Norway**

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   panel-specific AR(1)  (0.0433)

Estimated covariances      =         1          Number of obs      =        34
Estimated autocorrelations =         1          Number of groups   =         1
Estimated coefficients     =         6          Time periods       =        34
                                                Wald chi2(5)       =     38.20
                                                Prob > chi2        =    0.0000
```

Emissions	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
OilProduction	-.0006495	.0001878	-3.46	0.001	-.0010176	-.0002814
GDPCap	.0000196	8.40e-06	2.33	0.020	3.10e-06	.000036
PrimeMinister	-.2772762	.1017237	-2.73	0.006	-.4766511	-.0779014
MinistryPetroleum	-.1300661	.1453121	-0.90	0.371	-.4148727	.1547404
MinistryEnvironment	.2203013	.1813507	1.21	0.224	-.1351396	.5757423
country2						
Norway	0	(omitted)				
_cons	10.85712	.6272994	17.31	0.000	9.627634	12.0866

Ch.5 Analysis of Quantitative Results

Table 10: Summary of Independent Variables and Expectations

Category of Variable	Independent Variable	Operationalization	Source	Expected Correlation
Production Economy	Oil and Natural Gas Production	Thousands of barrels produced per day	United States Energy Information Agency (EIA)	+
Consumption Economy	Gas and Diesel Sales	Millions of liters sold annually	Swedish Energy Agency, Norwegian Department of National Accounts and Industry Statistics and Statistics Denmark	+
Consumption Economy	Population Density	People per square kilometer of land area	World Bank	-
Consumption Economy	GDP/Capita	Total wealth divided by population in current U.S. dollars	World Bank	+
Domestic Politics	Ministry of Environment and Norwegian Ministry of Petroleum	Manifesto Data	Manifesto Project-German Science Foundation	+
Domestic Politics	Prime Minister	Manifesto Data	Manifesto Project-German Science Foundation	+
International Politics	EU Policies	Large shifts in EU governance	European Union	+

Despite the data limitations previously discussed there are some points that can be taken away from the regressions presented in the preceding chapter. Some of my original hypotheses were proven wrong, while some results represented what I expected. To make it clear how the quantitative results compare to my expectations before estimating the regression models, Table 10 gives a summary of my predictions as well as how I chose to operationalize each variable and the data sources used to do so.

Production economy- Oil and Natural Gas Production:

To begin with, oil production is not found to be statistically significant in *every* regression ran as one might expect. In fact the regression ran with the most independent variables and thus most controls, Table 4, finds oil production to be insignificant. However, due to the statistical significance in Tables 5-9 (although the negative coefficient in Table 9 is concerning) this variable certainly seems to be a factor. Based on this statistical quantitative analysis oil production does not appear to be the only cause of Norway's increase in CO_2 emissions, however it does indeed seem to be a contributing influence. In terms of policy, this certainly suggests that Norway should consider stricter policies on oil production and reducing the amount of oil extraction activity permitted. Natural gas production was not included in the regressions presented due to collinearity with oil production, but the same applies to this variable as well. Although it is a huge source of wealth for the country, oil and natural gas are finite resources that will be depleted eventually and the long-term environmental risks and consequences are a cause for concern. It is not expected that a country that is heavily reliant on oil production as a source of revenue will immediately stop production altogether, yet a slow and steady shift of resources away from oil production and towards a renewable source that is more advantageous in the long term should be strongly considered and encouraged. This is especially true given that Norway has a large capacity for wind energy, similar to that of Denmark (Moe 2015). The recent decision of the Norwegian government to expand areas in which companies can extract oil and natural gas is precisely the opposite choice a country that claims to make the environment a top priority should be making. Decisions of this sort can have disastrous effects on the climate and thus not only the Norwegian people, but people all over the world.[11]

Consumption economy- Gas and Diesel Sales:

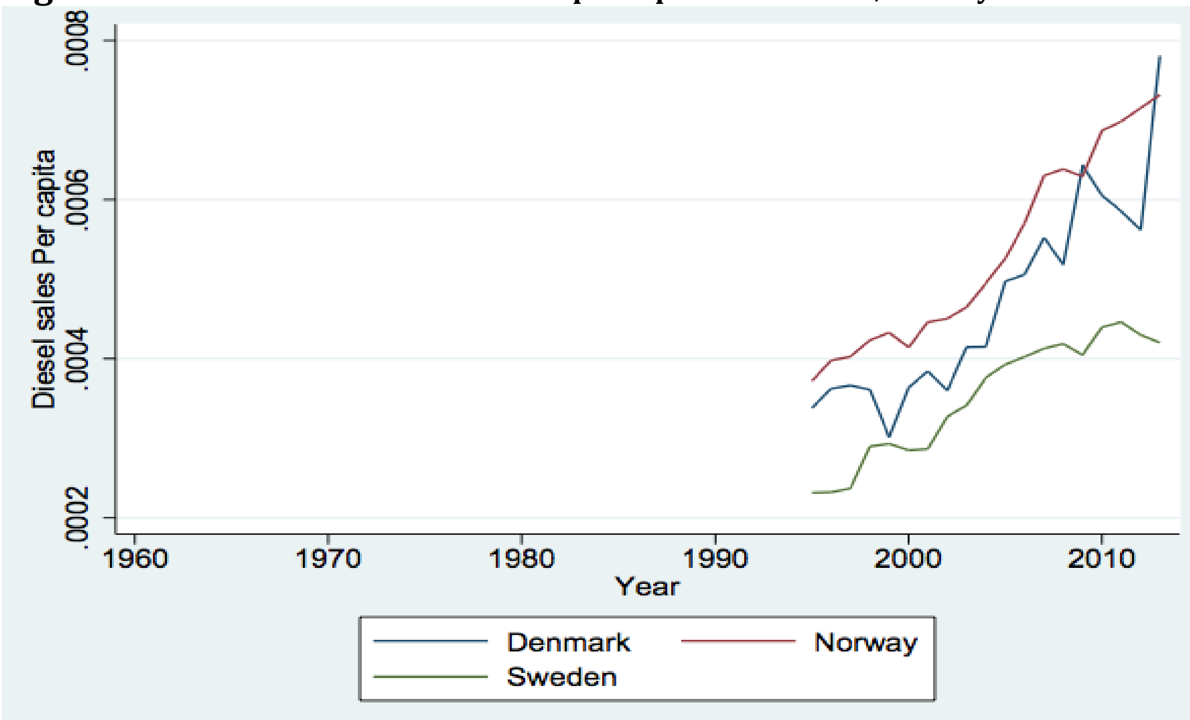
The variables that represent domestic consumption of fossil fuels, gas and diesel sales, does not appear to have a large impact on CO_2 emissions. Diesel sales have gone up dramatically since 1995 (see Figure 3) likely due to government subsidies, but this is also found to be the case for Denmark and Sweden; in fact, Norwegians purchase the least amount of *total* liters of diesel than the other two Scandinavian countries. However, when controlling for population, Sweden does purchase less than Norway. It is found in this statistical analysis that the shift towards diesel sales seems to lead to a decrease in CO_2 emissions in these countries. This is not to suggest by any means that consumption of diesel is *good* for the environment as there are high concentrations of other pollutants released by diesel fueled cars that increase GHG emissions in the atmosphere (U.S. Environmental Protection Agency 2014). However, in terms of strictly looking at CO_2 emissions in these countries a shift towards diesel cars cannot be considered the only or main reason for Norway's increased CO_2 emissions. Gasoline sales seem to have declined steadily in all three countries, with Norwegians purchasing the smallest total amount and Denmark purchasing the most (see Figure 4). The fact that Norwegians actually purchase

[11] It is also important to consider that this data only goes to 2013, and the recent expansion in areas approved by the Norwegian government to drill oil will provide an interesting opportunity for further research to more accurately examine the effects of oil and natural gas production on CO_2 emissions.

less diesel per capita than Denmark and the least amount of gasoline of the three observed countries proves my original hypothesis incorrect and suggests that use of diesel fuel is not a major contributor of CO_2 emissions. The regressions results also point to gasoline usage not being a major cause for concern, as it is not found to have a statistically significant correlation to CO_2 emissions. Increased usage of cars powered by renewable sources should undoubtedly continue to be promoted by the Norwegian government (and the Danish and Swedish governments), yet this does not appear to be a policy area in need of drastic changes.

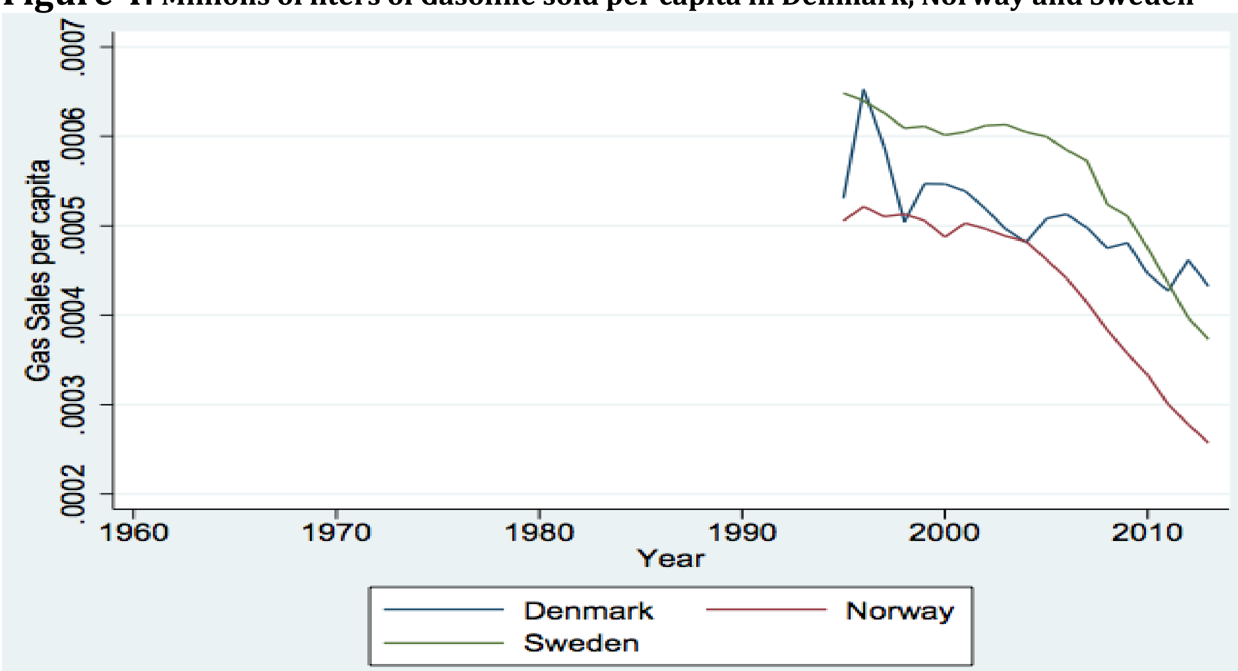
The quantitative results for both the fossil fuel production of oil and natural gas, and fossil fuel consumption of diesel and gas, seem to suggest that the former is having a much larger influence in the increasing CO_2 emissions in Norway. This is important in understanding where environmental policy adaptations are necessary. Based on the large amount of hydro powered energy in Norway and the relatively low consumption of diesel and gasoline it appears that Norwegian's consumption of fossil fuels is not the root of the problem of rising CO_2 emissions. This means that this issue has more to do with the production sector of Norwegian society as the oil production variable representing this category is of much more influence. Being that the Norwegian government is responsible for the regulations affecting this part of society, the government's actions are of more serious concern than the citizens', who seem to be taking environmental concerns seriously as is substantiated by not only their energy consumption, but public opinion as well.

Figure 3: **Millions of liters of Diesel sold per capita in Denmark, Norway and Sweden**



Data: Energimyndigheten in Sweden, Division for Energy and Environment Statistics, Department of National Accounts and Industry Statistics in Norway and Statistics Denmark

Figure 4: **Millions of liters of Gasoline sold per capita in Denmark, Norway and Sweden**



Data: Data: Energimyndigheten in Sweden, Division for Energy and Environment Statistics, Department of National Accounts and Industry Statistics in Norway and Statistics Denmark

Consumption economy- GDP/Capita and Population Density:

GDP per capita and population density are both found to be statistically significant to CO_2 emissions in every regression model estimated. I had expected GDP per capita to be an influencing factor yet had hypothesized that population density would actually have a negative correlation to emissions. I couple these two variables together in this analysis because they are both variables that are somewhat out of the Norwegian government's control. Therefore, they are important to examine yet major policy recommendations in this sphere are not realistic. Norway is not expected to attempt to directly reduce its wealth due to CO_2 emissions, although is likely this will indirectly be affected if oil and natural gas production is reduced. It also seems that the more densely populated these countries have become the more emissions have increased despite the possibility for centralized energy infrastructures and transportation systems. Both of these results suggest that the I= PAT formula previously discussed is in fact correct. The more population grows, despite how densely distributed, and wealth increases[12] the higher CO_2 emissions will increase. However, it is important to note that Denmark and Sweden's population and wealth have also increased in the time frame examined yet they have both seen declines in emissions.[13] This leads me to believe that it may matter *why* wealth and population are increasing. For Norway, wealth has undoubtedly increased due to it being one of the largest oil and natural gas producers and exporters in the world. It is also plausible that with this increased wealth, population is increasing as well due to people feeling more financially capable of raising children and more foreigners moving to Norway to be a part of the oil industry.

[12] An increase in wealth is likely lead to increased technology usage as well, although this is not specifically examined in this thesis.

[13] Norway's wealth has increased by a much larger margin though (CIA 2016).

Therefore, when looking specifically at Norway, the oil and natural gas industry is again where I see the most potential for policy reforms that could successfully decrease CO_2 emissions. However, the assumption of a specific correlation between Norwegian GDP/capita and population density being caused by the oil and natural gas industry is certainly a place for further research to be conducted.

Domestic Politics:

Tables 2-6 suggest that politics have little effect on CO_2 emissions across all three countries. The manifesto data for the ministries of environment and Prime Ministers of all three countries, which represents the effects of policy positions of the governing parties, are not statistically significant. However, when I remove Denmark and Sweden's observations, there is a statistically significant correlation between the salience of environmental topics in manifesto data for the party of Norwegian Prime Minister and CO_2 emissions. The number of observations is small making the validity of the regression questionable, but this correlation is apparent when looking at Norway's history as well. The period between 1990 and 1995, when Norway's emissions dropped the most since 1960 and continued to stay at a stabilized level, directly followed the release of The Brundtland report and was during the time Gro Harlem Brundtland was Prime Minister from 1986-1996. Former Prime Minister Brundtland entered the Norwegian government as Minister of the Environment and as exemplified by the Brundtland report, had a strong commitment to sustainable development. She encouraged *all* different sectors of government to work on this issue through White Paper 46, a method that has commonly been credited with the success in reducing emissions in Denmark and Sweden. Based on the quantitative, and especially the qualitative analysis, I find it extremely likely that the

Norwegian Prime Minister can play a substantial role in reducing CO_2 emissions. As the political leader of Norway, the Prime Minister decides the direction of the country and consequently the salience of environmental issues compared to other concerns. This is especially true of a strong Prime Minister in a single-party government. The Prime Minister has great influence over the ministries and this is particularly important given that the Ministry of Petroleum makes the assessment of how extracting oil will impact the environment. With Statoil's large influence in this ministry, having a head of the Ministry of Petroleum that is willing to stand up for the environment over the interests of this influential ministry is going to be pivotal in reducing CO_2 emissions. Putting people in power who will do this will ultimately depend on the Prime Minister.[14] The fact that no statistically significant correlation between the Ministry of Environment and CO_2 emissions was found is a cause for alarm in and of itself. The Ministry of Environment *should* be influencing one of the most important mechanisms to mitigating climate disasters. However, it seems that the institution that should be speaking on behalf of the climate and renewable energy is either easily overruled or does not find this to be as salient of an issue given that the manifesto data for this ministry is not correlated to emissions. Whereas in Denmark energy policy and climate policy are seen as integrated, this does not seem to be the case in Norway. Energy policy falls under the Ministry of Petroleum and Energy giving the petroleum an advantage over protecting the environment in this area. This has an effect on CO_2 emissions given its close relationship with energy systems and in particular oil and natural gas production. All in all, it is the domestic politics in Norway that I argue have the

[14] It is important to keep in mind that the Prime Minister must also consider the party that candidates belong to and possibility for a coalition.

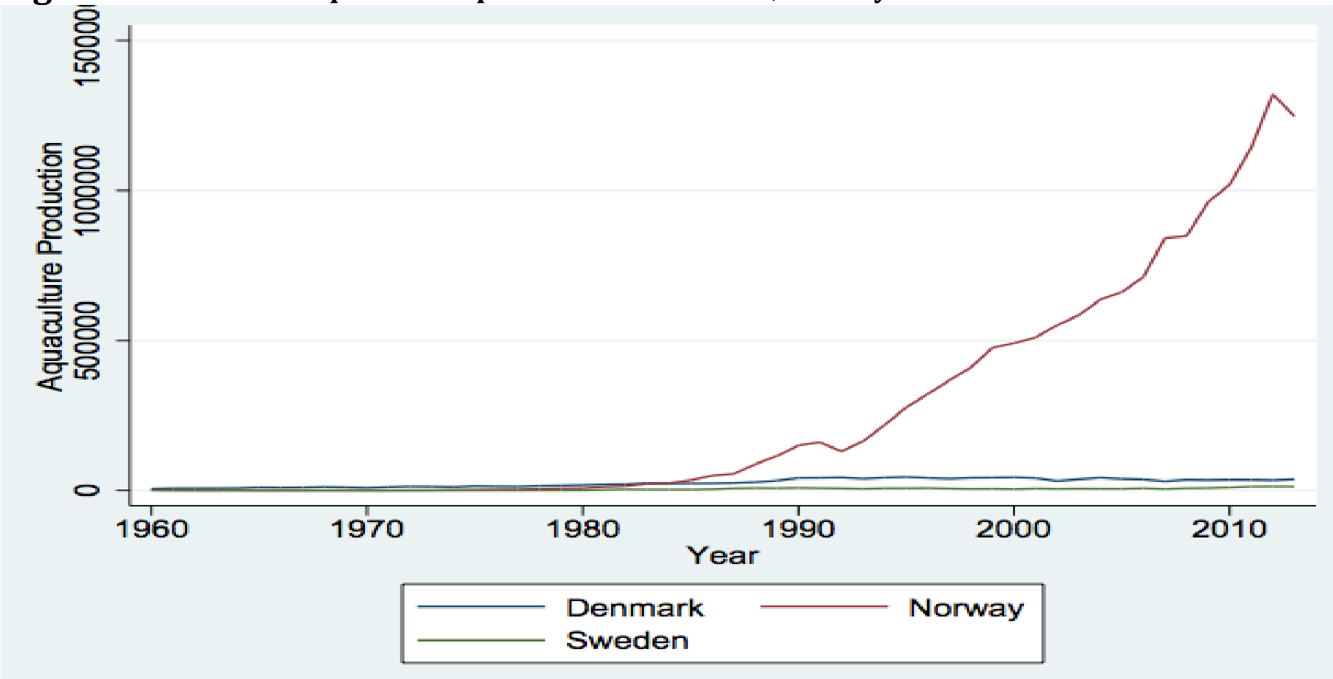
largest impact on CO_2 emissions and is where there needs to be institutional changes if Norway is serious about its claims to respect the environment and being a global environmental leader. There is a necessity for more collaboration between the Ministry of Environment and Ministry of Petroleum given how interconnected the climate and oil and natural gas energy sources are.

International Politics:

In terms of international politics, the regressions presented do not find any statistical significance in the correlation between CO_2 emissions and being a member of the EU for the three countries examined. This is not especially surprising considering Norway is a European Economic Area (EEA) member. Under the EEA Agreement, a significant portion of the EU's policy regarding the environment and climate change has been incorporated into Norwegian law (Regjeringen 2015). Norway has enjoyed a close collaboration with the EU in terms of environmental legislation due to their close proximity and since the EEA agreement entered into force in 1994, almost all EU environmental legislation has been implemented in Norway (Regjeringen 2015). In total, more than 250 pieces of environmental legislation have been included in the EEA Agreement with a primary focus on pollution (Regjeringen 2015). However, the areas of nature conservation, natural resource management and agriculture and fisheries are the exception (Regjeringen 2015). These areas are all specific areas of policy that may be interesting for further research to examine to assess if perhaps the EEA should include more regulations. Furthermore, the environmental legislation laid out through the EEA Agreement and EU policy establish minimum standards and the member states have the option to introduce stricter rules at the national level. Although the EU and the EEA Agreement lay out a basis for environmental action and legislation, Denmark, Sweden and Norway's national level laws are all likely to be stricter. Perhaps the exception in Norway is with aquaculture and fishing laws, as this sector of production is much larger than in Denmark and Sweden. Additionally, it has increased dramatically since 1990 as seen in Figure 5. Fisheries in developed nations, such as Norway, are completely dependent on combustion engines and portions of the fleets have very high consumption levels (Ellingsen, Olaussen and Utne 2009). Most fishing fleets consume a very large amount of energy, making them unsustainable. On a global scale, fisheries account for about 1.2% of global oil consumption which, to put into perspective, is approximately equivalent to the total amount of oil consumption in the Netherlands (Tyedmers, Watson and Pauly 2005). Fisheries are found to emit more than 130 million tons of CO_2 into the atmosphere as energy is consumed in all parts of the value chain from catching the fish to transporting it (Tyedmers, Watson and Pauly 2005).[15] Given this, it is likely this could be an area contributing to CO_2 emissions, therefore an increase in fishing and aquaculture environmental standards by the EEA Agreement may be beneficial to attaining environmental targets. However, being an EU member alone does not seem to be a significant factor in this case due to Norway's close relationship with the EU.

[15] This is not applicable to fish farming.

Figure 5: Tons of all aquaculture produced in Denmark, Norway and Sweden



Data: Food and Agriculture Organization of the United Nations

Ch.6 Conclusion: Summary of Findings and Implications for Norwegian Environmental Policy

This thesis sought to uncover the contributing factors to Norway's rising CO_2 emissions which are a puzzling phenomenon given Norway's high public concern for the environment, ambitious emissions reduction commitments at the national and international level and depiction as an international environmental leader. This is further exacerbated by the opposite trend in CO_2 emissions being observed in Norway's neighboring countries of Denmark and Sweden that are similar in many ways. I use the production economy variables of oil and natural gas production and consumption economy variables of gasoline and diesel sales, GDP/capita and population density. Additionally, I use the domestic political variables of salience of environmental issues to the political party the Prime Minister and cabinet ministers of the respective environmental ministries and the international political variable of European Union membership. I find the production economy and domestic political factors that influence it as being the most significant factors and thus areas for policy reform.

Many have argued that Norway has avoided the "resource curse" and when looking strictly economically, this is true since the distribution of wealth from oil and natural gas production to the whole of society, rather than solely a select few elites, is praiseworthy ad unique when looking at a global scale. However, the "resource curse" of abundant reserves of oil and natural gas may extend beyond economics in an unforeseen and unintended manner- that of the climate. The recent decision to issue the most oil production licenses in Norwegian history and expand petroleum activity to the farthest North it has ever reached in the Arctic Sea goes directly against Norway's rhetoric and international image of being an environmental leader, based on the findings that oil and natural gas production are indeed factors of rising CO_2 emissions. Beyond solely the discourse continually highlighted by the Norwegian government that the environment is a top priority for the country, this decision is also at odds with the recently ratified Paris agreement, the environmental targets committed to through the bilateral agreement with the EU and Norwegian citizens who have voiced their public opinion as being supportive of environmental action across all party lines. While on the one hand having the government closely involved and intertwined with the oil production process in a manner that has resulted in fair distribution of wealth to the citizens is notable, on the other this close relationship has gone too far in that government regulations are no longer keeping large oil companies, like Statoil, in check. Statoil's influence has saturated the Ministry of Petroleum and Energy in a manner that is alarming. Without a significant increase in checks and balances and collaboration between all sectors of government to address environmental issues, it is likely that the income from oil and natural gas production will continually be a larger priority to Norway, no matter which environmental agreements it ratifies. Checks and balances could be implemented between ministries to assure that the influence of the oil production sector is not saturating decisions regarding the environment. Cross-sector collaboration has been a vital aspect to Denmark and Sweden's success in reducing CO_2 emissions, and I argue is largely why Norway was able to decrease and stabilize emissions from 1990-1995 with the influence of Prime Minister Brundtland. Additionally, Brundtland's approach of asking the different ministries how they realistically believe they can reduce emissions, instead of imposing an unrealistic target, is ideal. However, since then the Ministry of Petroleum has become not only become far too influential, but too closely related with Statoil. If reducing CO_2 emissions is truly a concern for the Norwegian government, the environmental assessment of increased oil production and license issuing should be conducted by a part of government not partial to Statoil's priorities, such as the Ministry of Environment which has not had nearly as much influence as it should with regards to this issue (Moe 2015).

Oil and natural gas production are certainly factors in Norway's increasing CO_2 emissions and according to scientific experts, lowering CO_2 emissions is a vital part of mitigating the consequences of climate change. No current methods of addressing this issue are satisfactory as is demonstrated by the continual increase in emissions. For example, relying on the EU ETS as part of the solution has led to Norwegian companies spending too much effort investing in low-carbon projects in developing countries rather than making shifts towards reducing domestic emissions.[16] Furthermore, the intention of carbon capture and storage as the way forward is extremely risky. Although it may lower CO_2 emissions at first, the risk of a leak from a full-scale project is likely to be far more disastrous than the status quo. With the failure of the EU ETS and the carbon tax to incentivize the necessary shift towards new energy sources and production methods, this basically leaves Norway with one option to reduce CO_2 emissions: shift away from oil and natural gas production and towards a renewable source of energy such as wind power. In fact Norway has a wind power potential that exceeds most countries, and is comparable to that of Denmark (Moe 2015). This should be where resources are focused, not on drilling more oil or on full-scale CCS projects so oil can continue to be extracted. This kind of shift

[16] It should be acknowledged that low-carbon projects in developing countries of course provide a benefit in combatting climate change at a global level.

in energy production cannot happen immediately, however a dedicated gradual shift is the best solution for the long term health of the planet and therefore the people of Norway. Furthermore, if any country is capable of doing this it is Norway and this would substantiate Norway's image and rhetoric of being an environmental leader.

While gasoline and diesel use does not appear to be a major concern for Norway, shifts towards cars fueled by renewable energy should continue to be promoted as a society with mostly renewable cars is ideal for reducing CO_2 emissions. Similarly, it does not seem that European Union membership has made a large difference in this case due to Norway being a member of the EEA. This is not to say that international politics do not matter when looking at environmental concerns, but that in the case of Norway this is not an area to worry much about as Norway has participated greatly in international negotiations. However, while Norway's emissions increase despite the rhetoric and commitments made at the international level, it may cause other countries to lose trust and Norway's accountability may start to be affected. Furthermore, with no regulations from international agreements on aquaculture and a large increase in this sector of production, stricter rules from the EEA should be considered in this area. Again, this points to the production part of Norwegian society being a much larger contributor to CO_2 emissions than Norwegian citizens' consumption.

There is a great deal of further research that can and should be done regarding this issue. Norway is a fascinating case for environmental policy analysis for several reasons, but primarily in the context that it is one of the largest fossil fuel energy producers in the world, while also claiming and commonly considered to be an environmental leader. The environmental decisions that Norway makes in the future will have considerable effects on not only Norwegians, but the entire planet. However, this topic is very complex and statistical analysis alone cannot provide all the answers. The primary areas for which further research is recommended are exactly how Norway could shift from oil and natural gas production to an alternative source of energy such as wind, what the costs and benefits of this would be in terms of creating the new technology needed to produce wind energy and the losses incurred from less oil and natural gas production and the political feasibility of such a task. Furthermore, how the government can specifically create more checks and balances on the Ministry of Petroleum and Statoil in the meantime and promote cross-sector collaboration on climate concerns.

With Norwegian public opinion in favor of caring for the environment, the Norwegian government has a responsibility to act on this and start to shift towards less reliance on oil and natural gas production as a source of energy and income. Changes are necessary within the institutions of domestic politics that control oil and natural gas production, and I find that the Prime Minister *can* make a difference in reducing CO_2 emissions. Norway is absolutely capable of making the changes necessary for the long-term health of both its citizens and the planet. However, this will require making a choice that has largely plagued environmental progress in this country: the health of the environment or the health of a booming fossil fuel production industry. In order for Norway to live up to the notion that it is an environmental leader, it must choose the former.

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