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Climate Policy Choices

Do Environmental Taxes work? A Mixed Method Study of the OECD and Norway

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Abstract

Til tross for en overveldende vitenskapelig konsensus om klimaendringer, finnes det ingen konsensus om hvilken tilnærming som raskest sørger for reduserte utslipp. Diskusjonen rundt ulike policy tilnærminger står i stor grad mellom om å straffe det gamle systemet eller om å støtte det nye. Ved å benytte en regresjonsbasert tilnærming med landbaserte panel data fra 32 OECD land fra perioden 1990 til 2012, samt gjennomført et case studie av Norge, har jeg analysert ulike policy tilnærminger for å redusere klimautslipp. Disse er miljøskatter, offentlig finansiert forskning og utvikling (FoU) og teknologi diffusjon som proxy for teknologi og innovasjonspolicy. Resultatene fra analysen av OECD og det norske case studiet tyder klart på at miljøskattene ikke har vært særlig effektive til å redusere klimautslipp. En sannsynlig forklaring på dette er at det ikke har vært politisk mulig å innføre miljøskattene på et nivå hvor de fører til systemendring og endret adferd. Derimot tyder resultatene på at offentlig finansiert FoU og teknologi og innovasjonspolicy gjennom å støtte diffusjon av ny teknologi begge ser ut til å ha vært mer effektive til å redusere klimautslipp. En tolkning av disse funnene er at selv om FoU og teknologi og innovasjonspolicy ikke er like kostnadseffektive, er de begge potensielt systemtransformerende.

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Any remaining errors are solely my own responsibility.

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1 Introduction

Climate change is seen as one of the greatest challenges facing mankind today. The ever increasing evidence that human activity is a major contributing factor to the increase of greenhouse gases in the atmosphere is established to the point of scientific consensus (Wang et.al, 1976; Unger et.al, 2000; Hansen et.al, 2007; IPCC, 2013). The Intergovernmental Panel on Climate Change (IPCC) unequivocally state that the; "human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system" (Stocker et.al, 2013). Respected British economist and climate expert, Lord Nicolas Stern warns of dire consequences if we continue on the observed path, suggesting it would most likely lead to temperatures rising above 4°C by 2100. He predicts that "such warming would disrupt the lives and livelihoods of hundreds of millions of people across the planet, leading to widespread mass migration and conflict" adding, "that is a risk any sane person would seek to drastically reduce" (Harvey, 2011).

As governments around the world are starting to pay more attention to the climate challenge, there is an ongoing debate of policy approaches. Apart from the traditional environmental policy approach of technology or emission standards (Dryzek, 2013), the market-based approach has the broadest support. It is deeply theory-driven from the economic literature, with the assumption that the free market is best suited to correct for negative externalities like pollution with incentives like a tax, and would allocate resources in the most optimal way (Baumol & Oates, 1988; Eskeland & Jimenez, 1992). The market-based approach took center-stage as a preferable policy option after the United Nations conference on Environment and Development held in Rio Janeiro, June 1992. This major conference, often called the Earth Summit, incorporated environmental taxes as a desirable policy option for emission reduction. The 16th principle of the Rio Declaration states that; "National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment" (UNEP, 1992).

Thus, the precedence of market-based solutions began to take hold in international climate policy negotiations, and the belief that they provide the most optimal solution to solving climate change. And while most developed countries have managed flat emission rates in the years after the 2008 financial crisis, some even turning negative, there is still a long way to go to substantially reduce greenhouse gas emission emissions. In order to do so, there are many who believe that the only way to manage this would be a global agreement that incorporates some form of global carbon pricing mechanism (Patt, 2015). Thus, a global carbon tax is seen by many as the holy grail of market-based instruments (Mankiw, 2007; Nader & Heaps, 2008; Avi-Yonah & Uhlmann, 2009; NOU 2015: 15). Some of the largest and most influential financial institutions and even some of the largest actors in the petroleum industry subscribe to this approach. Both the World Bank and IMF are strong supporters of market-based instruments (IMF, 2015, World Bank, 2014). And in a joint statement, 6 of the largest European petroleum companies said to be in favor of a carbon tax, citing that stable and long term policies that make carbon more expensive would deal with some of the uncertainty for the future and in turn could stimulate investment in efficiency and abatement measures for the industry (Bloomberg View, 2015). With this broad support and a strong theoretical foundation, there should be every reason to expect that market-based instruments work. But is there sufficient evidence for this? what does the empirical record tell us?

While most experts argue that in theory, market-based instruments should work best, there are many problems with them in the real world. It seems quite clear that if we are to put all effort into creating a global carbon tax scheme, such an approach should be strongly anchored in reliable evidence and a solid empirical track-record of its effect on emissions reduction. But this we do not have. Rather, it could easily be that these market-driven instruments are diversions that take our focus away from what actually works.

One of those who believe that market-based instruments have been a diversion is Professor Anthony Patt at ETS Zurich and one of the lead authors of the IPCC 2014 working group's Summary for Policymakers. He believes that market-based instruments actually have not been particularly effective in reducing greenhouse gas emissions (Patt, 2015). And since our estimated carbon budget is being used up much faster than we would like (IEA, 2010; Vuuren et.al, 2011) it leaves us with very little time for missteps and sidetracks. So instead of concerning ourselves with the theoretical beauty of market-based instruments, we should rather focus on policies that are known to have worked.

He points to Germany and its push for renewable energy deployment under the characteristic name *Energiewende* (roughly translated "Energy transformation"). Under the support policy scheme called feed-in-tariffs, the German government has created incentives for investment and growth in solar photovoltaics (PV) and wind (Patt, 2015).

Thus my suspicion, which is the one I will test in this thesis is that market-based instruments actually have not worked particularly well, and that there are other policies that have had far greater effects. Using cross-country panel data from 32 OECD countries ranging from 1990 to 2012, I will investigate the effects of market-based instruments like environmental taxes and their impact on effectively reducing greenhouse gas emission. Then I will compare these results with other alternative policy approaches such as public funded research and development (R&D) and technology & innovation policy. To supplement the quantitative analysis, I have also decided to do a case study of Norway. Anecdotal evidence from Norway claims that the Norwegian CO_2 tax has been a success, it will therefore be interesting to study Norway to see if market-based instruments have worked there.

On this basis, the central research question for the thesis is:

Do market-based instruments like environmental taxes effectively reduce greenhouse gas emissions?

In an extension of this, I hope to add to the scarce empirical record of the effects of different policy approaches for effective emissions reduction. More precise, I will add to the lack of longitudinal analysis of the effects of various policy approaches aimed at reducing emissions. With the Norwegian case study, I wish to better understand the mechanisms and the political negotiations which affect policy outcomes. The case study presents me with an opportunity to investigate my broader empirical findings in a much more specific manner, and hopefully bring more evidence-based inference.

The structure of the thesis is as follows. In Chapter 2, I present the theoretical framework. First I present a short overview of the climate science, the greenhouse effect and our current understanding of how additional greenhouse gas might affect our planet. The accumulation of this understanding is then presented by a short review of the current IPCC and IEA scenarios. Following the brief introduction to the current state of climate science, I present the theoretical framework and empirical record of three distinct climate policy approaches that presents policy options towards effective emissions reduction. These are market-based instruments with a specific focus on environmental taxes, governmental R&D expenditure, and finally, technology and innovation policy. I conclude each policy approach section by presenting hypotheses that are constructed on the basis of the theoretical and empirical discussion.

Chapter 3 presents my methodological approach. I start by presenting a short introduction of the constructed OECD dataset. Following this, I present a thorough description of the dependent variable, Greenhouse gas emissions, followed by a detailed description of the three independent variables and the control variables. Thereafter, the statistical method used in the thesis is presented, where the time-series cross-section model and model specifications are thoroughly discussed. I then present a short discussion of the mixed methods approach, followed by my reasons for the Norwegian case selection, as well as a brief overview of single time-series methodology and the Norwegian model specifications. Finally, I present the time-series cross-section model with the data from the OECD, followed by a brief summary of the regression results.

I present the case study of Norway in Chapter 4, and start with a short review of Norwegian climate policy history. Thereafter, I discuss the empirical trends apparent from the Norwegian data, such as official statistics for emissions, tax rates and revenue, before I present the Norwegian model results. Finally, I present a discussion of the Norwegian case with input from the four experts I have interviewed, before I present some case specific concluding remarks.

In Chapter 5 I present a thorough discussion of the results from the quantitative and the qualitative analysis. Here, I discuss plausible interpretations of the data in relation to the theoretical framework presented in the thesis, followed by a discussion of how these policy approaches might be affected by technological advances and other x-factors in the future. I then present a short summary of this discussion before the final conclusion is presented in Chapter 6.

My main finding from the quantitative analysis is that market-based instruments like environmental taxes have not been particularly effective at reducing greenhouse gas emissions in the OECD. This is also supported by the qualitative case study of Norway. Rather, it is likely that there are other alternative policies that have had a greater effect on reducing emissions. To that point, my analysis show that governmental R&D expenditure and technology and innovation policies have had a greater impact on emissions. The analysis investigates governmental R&D expenditure on environmental protection and technological diffusion as a proxy for the effect of technology and innovation polices on greenhouse gas emissions. Both of these exhibit a negative significant relationship with emission. On the basis of the evidence presented in the thesis, one plausible explanation for these results are that, while environmental taxes might provide us with a more efficient system, they do not produce systemic change. And if market-based instruments are a sidetrack, then perhaps we should focus on supporting the new technology, rather than trying to punish the old. This points in the direction of R&D and technology diffusion, and while these policies might not be the most cost-effective, they arguably have a more transformative effect.

2 Theory

2.1 Climate science and the greenhouse effect

The dynamics and processes that govern the climate is a complex and complicated field of science, and while some part of the climate system is not fully understood, other parts are understood quite well. Among these is the effect of greenhouse gases. A greenhouse gas (GHG) is any gaseous compound in the atmosphere that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere (Lallanilla, 2015). The greenhouse gases are; water, in form of water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and chlorofluorocarbons[1] (CFCs). As a consequence of the Montreal protocol, chlorofluorocarbons have for the most part been replaced by hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and lastly sulfur hexafluoride (SF_6) (EPA, 2015; OECD, 2015). In addition to the GHGs, scientists also measure so-called *short-lived climate pollutants* (SLCPs), which are not necessarily all gases. These are namely sot (or black carbon) that reduces a surface's albedo[2], speeding up the ice melting in places like the Arctic and Antarctic regions. This will likely lead to sea level rise and a less reflective surface to reflect incoming solar radiation, causing further warming of the planet. Many large cities around the world also suffer from major air pollution problems, due to high level of another SLCP, NO_x[3]. Common for most of these SLCPs are that they are relatively short lived in the atmosphere compared to the long-lived climate pollutants like CO_2 that can stay in the atmosphere for hundreds of years (UNEP, n.d).

We measure the greenhouse gases' impact on the climate by looking at their relative *global warming potential* (GWP), usually over 100 years[4]. All GHGs have an estimated GWP[5] and

[1] Often called F-gases, most of this type of emission was slowed and regulated by the Montreal Protocol in 1986 due to its evident harmful effect to the ozone layer (Patt, 2015)

[2] Albedo is a non-dimensional, unit-less quantity that indicates how well a surface reflects solar energy (NSIDC, 2016).

[3] NO_x is a generic term, the product of a chemical reaction between nitrogen (NO), oxygen (O) and even hydrocarbons, especially at high temperatures, e.g. in combustion engines or jet engines. NO_x is mainly coming from automobile exhaust and industrial facilities. Hot city days can result in NO_x reacting with sunlight and volatile organic compounds (VOC) to create ground level ozone (O_3)[3] and airborne particles, which are the main ingredients in smog. Due to the problems of smog in major cities around the world, experts warn of their danger to the environment and human health (UNEP, n.d; EPA, 2015).

[4] Scientists measure other GHGs effect on climate with carbon dioxide as reference; methane's GWP is 25 and nitrous oxide is 298 over 100 years, meaning that nitrous oxide is almost three-hundred times more potent greenhouse gas than CO_2.

[5] If we measure the various greenhouse gases relative concentration in the atmosphere, we can see that water vapor can make up between close to 0 up to as high as 4%. In comparison, CO_2 concentration only makes up

in order to simplify and standardize measurements to measure and compare the impact of greenhouse gases on the climate, the United Nations Environmental Programme (UNEP) and the Intergovernmental Panel on Climate Change (IPCC) now uses the generic term; CO_2 equivalent (CO_2e). This is now the most widely used measurement for GHG emission for analyzing man-made emission data. The most problematic aspects of GHG emission measurement is that we are dealing with, for the most part, gases that are produced by natural processes. So in order to properly analyze man-made climate impact, scientist have to rely on what we currently understand about the climate system and by using the best estimated data possible.

As climate scientists for the most part agree on what is happening and what will likely slow down the effects of climate change, is it then possible to develop methods and technology that decouple CO_2 emission from the burning of carbon based fuels? Can we produce energy from fossil fuels without adding more CO_2 into the atmosphere? The answer is frankly no, with the exception of sequestration (storing captured CO_2, usually known as carbon-capture and storage (CCS)) and afforestation. And according to Sinn (2008) the reason lie in the laws of chemistry:

> Fossil fuels basically consist of molecules that are composed of carbon and hydrogen. Oxidation generates usable energy, converting the carbon into carbon dioxide and the hydrogen into water. In fact, with all fossil fuels the ratio between the carbon burned and the amount of carbon dioxide produced is the same chemical constant. (…) There is, of course, the possibility of increasing the efficiency of combustion processes by avoiding a waste of oxidizable carbon or a waste of heat generated by oxidation, but this does not contradict this statement. The laws of chemistry imply that demand reducing measures will be unable to mitigate the greenhouse effect unless they succeed in also reducing carbon supply (Sinn, 2008, p. 363).

So the general position is that at some point in the near future, humans have to start to drastically reduce and eventually make away with the most of its fossil-based energy use, and

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0.04% or 400 ppm (parts per million). Methane makes up only 2 ppm and nitrous oxide 0.3 ppm of the atmosphere, but as explained they are far more potent. Sulfur hexafluoride is by far the most potent of the GHGs with a GWP 23.900 times higher than CO_2, luckily it only measures about 0.7 parts per trillion in our atmosphere (Patt, 2015).

replacing them with alternative forms of energy. As policymakers prepare efforts to deal with this reality, they rely on insight from climate models and climate scenarios. Both the IPCC and the International Energy Agency (IEA) produce emission scenarios and atmospheric GHG concentration trajectories that are invaluable to make evidence-driven decisions.

2.2 International Energy Agency

IEAs annual report *World Energy Outlook* produces three main emission scenarios. The *New Policies Scenario* is the current baseline scenario. It incorporates policy commitments and plans for fighting climate change, including pledges on the national level to reduce GHG emission and other environmental policy, even if such commitments have not yet been implemented. The *Current Policies Scenario*, IEAs former reference scenario, assumes no chance from the mid-point of the year the report is published, and is often used as a worst-case scenario. Lastly, the *450 Scenario* is an energy pathway scenario that is consistent with the goal of limiting the global temperature to 2°C, keeping concentration of atmospheric CO_2 around 450 parts per million (IEA, 2016a).

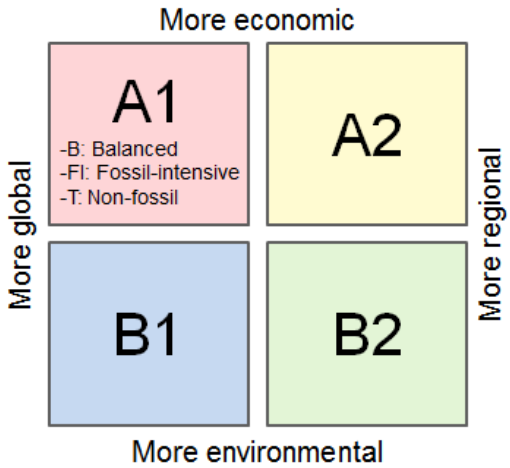
Furthermore, the IEA publishes the *Energy Technology Perspectives*, an annual publication on energy technology. Here comparable scenarios are outlined, with different energy system emissions trajectories. *The 2℃ Scenario* (2DS) is the main focus of the publication. It outlines an ambitious target of cutting energy-related emissions by more than half in 2050, compared with the baseline year 2009, as well as making sure reduction in emissions post-2050. One of the main acknowledgements of the 2DS is that transformation of the energy sector is crucial, but not the sole solution, as it also accounts for deep emission cuts in non-energy sectors. Comparably, the 2DS is consistent with the 450 Scenario in World Energy Outlook through 2035. *The 4℃ Scenario* (4DS) serves as the primary benchmark scenario in ETP 2012 when comparisons are made between scenarios. It is broadly comparable to the New Policy Scenario in the World Energy Outlook through 2035, with a projected long-term temperature rise of 4°C. Accounting for pledges to limit emissions as well as serious efforts to improve energy efficiency, the scenario is considered quite ambitious, requiring changes in both policy and technologies, with significant additional emission cuts after 2050.
The 6℃ Scenario (6DS) is consistent with the Current Policy Scenario in World Energy Outlook and is considered an extension of current energy and emission trends. It outlines that

by 2050, energy use almost doubles compared with the reference year 2009, with greenhouse gas emissions rising even more. Outlining no special efforts to slow or stabilize emissions, the scenario projects at least a 6°C global temperature rise (IEA, 2012; IEA, 2014).

2.3 Intergovernmental Panel on Climate Change

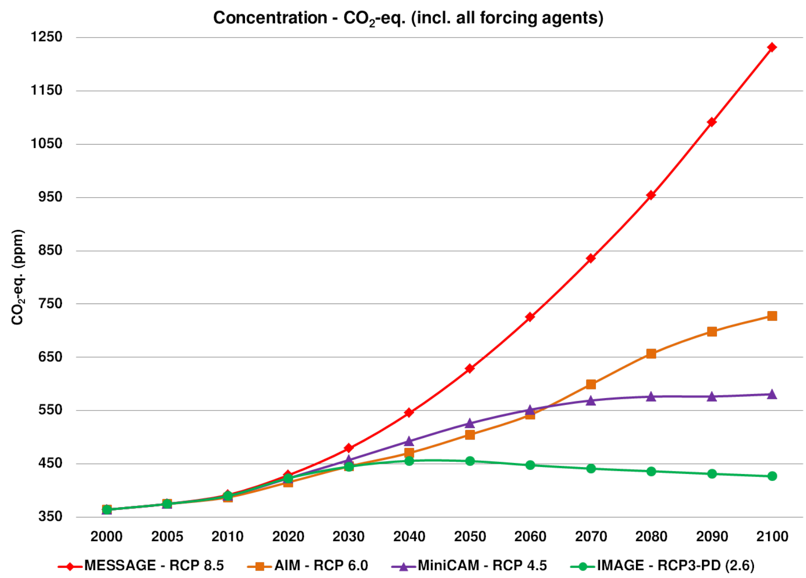
In 2000 the IPCC produced a set of emission scenarios called *Special Report on Emission Scenarios* (SRES) as showcased in figure 1. The SRES divide emission scenarios into a 2 by 2 table where the A-scenarios are more economical and B-scenarios are more environmental. 1 and 2 describe more global or regional. All the four main categories have three sub-scenarios, with a balanced, fossil-intensive and non-fossil version.

Figure 1: IPCC SRES



As stated in the report, the climate system is a very complex and dynamic system. Therefore, is it very difficult to predict future outcomes with uncertain features such as feedback-loops, demographic development, social and technological change. The purpose of these scenarios was to assist in "climate change analysis, including climate modeling and the assessment of impacts, adaptation, and mitigation" (Nakicenovic & Swart, 2000 p. 3). The SRES was in 2014 superseded by a new set of scenarios called *Representative Concentration Pathways* (RCPs). As data improves and computing power gets better over time, climate modelers are able to make more powerful models with higher temporal and spatial resolution (UCAR, 2011). The RCPs also represent a different approach to climate modeling. The RPCs represents a condition for Earth in the year 2100, and that the condition is defined by how much extra energy might be added by 2100, compared with pre-industrial values. By having pre-determined endpoints of measured greenhouse gases in the atmosphere in parts per million, scientists and policymakers can pick concentration pathways that lead to those conditions in 2100. There are many arrangements of social, political and economic combinations that could lead us there. So in a sense, the RCP is a reverse approach from the SRES. Rather than defining different narratives, then the implications of greenhouse gas emissions, the RCP approach defines a greenhouse gas trajectory, then people can discuss the variety of scenarios that might correspond with these (Burch & Harris, 2014).

Figure 2: IPCC Representative Concentration Pathways



According to Van Vuuren et al. (2011) and their overview of the different pathways, "the RCPs are the product of an innovative collaboration between integrated assessment modelers, climate modelers, terrestrial ecosystem modelers and emission inventory experts" (Van Vuuren et al., 2011, p. 1). The four main RCPs range from 2.6 to 8.5 W/m^2 radiative forcing value in year 2100 with underlying integrated assessment model outputs for land use, atmospheric emission and concentration data across all scenarios for consistency with historical observation, while preserving individual scenario trends. Rather than being interpreted as a forecast, the RCPs should be viewed as policy perspectives. Policymakers can thus use RCPs as reference for proposed policy action and compare these to make better decisions. It is however, important to note that of the four RPCs shown in Figure 2, the RCP3-PD (RPC 2.6 Peak and Decline) is the only pathway consistent with the 2°C target.

2.4 Policy framework

The theoretical principles behind the causes and drivers of climate change are now understood well enough for the scientific community to regard it *highly likely* that human activity is causing Earth to warm at unprecedented rates. As scientific consensus on climate change has been established, the political world is starting to respond, albeit very slowly. Following the efforts of COP21 in Paris, December 2015, 195 countries drafted the Paris Agreement to: "[hold] the increase in the global average temperature to well below 2 °C above pre-industrial levels and [pursue] efforts to limit the temperature increase to 1.5 °C above pre-industrial levels" (UNFCCC, 2015). Although the Paris Agreement does not describe any specific policy mechanism or any form of regulation to reach these goals, it does however, set an important precedence – the world has to move to a low-carbon future. In an ideal world, policymakers would create policy that reduces greenhouse gas emission at the lowest possible cost, without compromising other political goals. However, the political reality is very different. Policymakers have to consider how to reach stringent climate goals without compromising too much on other highly legitimate political goals. Thus, policymakers can use the cumulative insight from IEA scenarios and the RCPs to assess policy efforts relating to climate change mitigation and adaptation.

For analytical clarity I have decided to explicitly describe and investigate three different climate policy approaches that can be used to reduce greenhouse gas emissions. These are by no means all of the different policies within the realm of climate policy. They do however cover much of the ongoing debate over climate policy choices. The first is market-based instruments, usually associated with carbon pricing mechanisms, either as cap-and-trade or environmental taxes. The second is governmental R&D funding, generally viewed as one of the ways to measure state-commitment in researching and developing new low-carbon and environmental protection related technologies. The last approach covers technology and innovation policy. Instead of imposing tax regulation or caps for fossil-fuel production and consumption, the focus is rather on the rapid diffusion of green and environmentally friendly technology needed to reach cost-reduction for these technologies for a clean energy transition and sufficient protection of the environment.

Of the three, the most dominating policy approach in today's climate policy discussion has so far been the market-based approach. Although the pendulum has occasionally swung between market-based solutions and other approaches, like feed-In-tariffs (a support scheme that would fall under the technology and innovation policies), for economists and financial departments around the OECD the obvious solution has always included some form of market-based instrument, like a carbon tax or cap-and-trade systems. Being the dominating policy approach, this chapter will start with the theoretical foundation of market-based instruments, as well as a handful of empirical studies of the effect of these instruments and their ability to reduce greenhouse gas emissions. Next, I will be looking at governmental R&D funding as a measure of the State's role in actively reducing greenhouse gas emissions. As R&D expenditure is needed in early phases of risky and costly projects, public R&D funding can help mitigate risk and deal with uncertainty for some of these projects. R&D is also seen as a vital component for a country's competitiveness and is seen by many as a prerequisite for innovation, leaving some to argue that governmental R&D is one way the government can promote the country's future green industry competiveness, creating growth and jobs while reaching stringent climate goals. Finally, I will be looking at technology and innovation supporting policy. This is seen as an alternative solution to solve the challenges we face with climate change. Technology and innovation are seen as key drivers to solve the problems we will face for climate change. According to proponents of this policy approach, countries that are seen as being serious about dealing with climate change, end their pursuit of the unobtainable levels that market-based instruments have to be at in order to function like they do in theoretical models. They would call the effect marked-based instruments have produced, at best "tinkering at the margins", and argue that they will not produce systemic change. They instead advocate aggressive technology policy at the core of climate action to promote and boost the diffusion of technology and innovation that would hopefully lead to cost-reduction to help new clean alternatives to compete with their fossil-based counterparts. They want policy that creates an environment that makes it easier to invest and build renewable energy capacity, electrical vehicle subsidies and more stringent policy to promote energy efficiency. For some that even entails carefully selecting which technologies to promote, thus leaving principles of technological neutrality behind.

2.5 Market-based solutions – "Getting the price right"

The dominating paradigm in the climate policy discussion in the OECD is market-based solutions. For economists, market-based policy instruments like environmental taxes and cap-and-trade schemes have always been the endgame of any meaningful climate negotiation.

These instruments have deep roots in the economic literature. In modern environmental economics they offer a theoretical solution for the most efficient environmental protection and performance. Both these policy tools present economists with a market mechanism to allocate scarce resources while reaching environmental goals at the lowest possible cost (Baumol & Oates, 1988; Hahn, 1989). In contrast, the traditional environmental protection approach has been governmental regulation, often called "command-and-control" regulation. These regulations are usually called technology or emission standards. According to the OECD (2001a) an emission standard is the maximum amount of polluting discharge legally allowed from a single source, mobile, or stationary. There are often negative sanctions if these standards are not upheld by companies. The economists would however argue that these are regulatory approaches that leave little flexibility in means to obtain both economic and environmental goals (Portney & Stavins, 2000).

The first to propose a market mechanism to deal with externalities was the British economist Arthur Cecil Pigou. The OECD now defines externalities as "situations when the effect of production or consumption of goods and services imposes costs or benefits on others which are not reflected in the prices charged for the goods and services being provided" (OECD, 2003). Pollution is then a good example of a negative externality, but there are also examples of positive externalities, such as construction of a new road or new telephone lines connecting previously remote areas to a wider network (Khemani & Shapiro, 1993). According to Kete (1994) there is an underlying recognition that environmental and economic issues are two sides of the same coin. Pollution is wasted resources that both impose costs on the production side (e.g. from an environmental tax or regulation) and others in the society (e.g. waste management and storing, various health problems). So in order to correct for the negative externality, governments should put a price on the pollution to incentivize firms to change behavior or have them pay for causing environmental degradation. This is often referred to as the "polluter pays" principle (OECD, 2001b).

As climate related issues are moving further up on the political agenda, we are seeing a clear shift in the handling of climate related issues from the jurisdiction of the Ministries of Environment towards the Ministries of Finance, and consequently a shift in the discussion of climate policy from traditional emission standards regulation towards a push for marked-based solutions. The use of market-based instruments (MBI) for environmental protection is currently being promoted by global financial institutions such as the World Bank and the International Monetary Fund (World Bank, 2014; IMF, 2015). Within the OECD green tax reforms, like carbon tax, are increasingly gaining popularity and support (EEA, 1996; OECD; 1997; Baranzini et.al, 2000; Kasa, 2000; Christiansen, 2001; NOU 2015: 15). These market-based instruments are defined as policy instruments that use markets, price regulations, taxes, and subsidies in order to correct market failures like pollution (Kete, 1994). According to Portney & Stavins (2000), MBIs "harness market powers, because if they are well designed and implemented, they encourage firms (and/or individuals) to undertake pollution control efforts that both are in those firms' (or individuals') interests and collectively meet policy goals" (Portney & Stavins, 2000 pp. 31-32).

Finally, when it comes to environmental taxes, they would arguably provide a so-called double-dividend effect. The first being that an increased cost will lead to less pollution and secondly, that the government can use the tax revenue generated from these environmental taxes either by reducing other taxes or spending it on additional environmental protection. However, it is important to note that the double-dividend hypothesis has been under heavy scrutiny and still remains debated (Fullerton & Metcalf, 1997; Skatteministeriet, 2015). While the theoretical argument for environmental taxes is persuasive and well founded in the literature, there are surprisingly few studies that show that these taxes actually have had much effect. Among the few, is a study of the Australian carbon pricing scheme in the electricity sector from 2012 to 2014. O'Gorman & Jotzo (2014) find that the carbon price worked as expected in the short-term, but that it did not change investment behavior due to the uncertain nature of the pricing scheme and long-term policy commitment. The study concludes that the carbon price scheme reduced overall emissions in the Australian power sector, but not without some other consequences. When the tax was introduced in 2012, the extra cost made a difference in the merit order, with the utility companies turning off high emission brown coal power plants, while ramping up hydropower. While the emissions fell, the utility companies had to make up for the loss in capacity, and this resulted in an unsustainable use of hydropower, that severely depleted existing reservoirs (Plumer, 2014). Although the tax's environmental effect on emissions makes for a plausible case, O'Gorman & Jotzo also found that when electricity demand and emission intensity of the supply declined by about 4 percent and overall emissions fell by 8.2 percent, it was the electricity customers who paid for it. Electricity prices for households and industry rose with an average of 10 percent and 15 percent respectively. The tax was repealed in 2014 by the newly elected government and emissions rose in the following 100 days (Hoyle & Taylor, 2014).

Norway introduced a CO_2 tax in 1991 and several studies have tried to investigate its unique effect on emissions. Bruvoll & Larsen (2002) find in their study of the Norwegian CO_2 tax that the isolated effect of the tax has been modest at best. Since total emissions in Norway has increased, the study looks at emission per unit of GDP and in the period from 1990 to 1999, an observed 14 per cent reduction in total CO_2 emissions, due to changes in the energy mix and energy intensity. As Norway's primary policy instrument to address climate change, the study finds that the relatively high carbon tax can only account for 2 per cent of the reduction. Since the Norwegian petroleum production has increased dramatically since the tax was introduced, it is especially difficult to decouple the unique effect of the tax with other plausible factors that also can account for reductions in Norwegian emissions per unit of GDP (Bruvoll & Larsen, 2002; Norks Petroleum, 2016).

In another study of the effects of environmental taxes, Lin & Li (2011) use the method *difference-in-difference*, a statistical method trying to mimic the natural experiment (Angrist & Pischke, 2008), to compare the effect of carbon taxes in five north European countries[6] with a control group. They find that the real mitigation effect on emission is very different for each of the five countries, with the tax rate and tax exemption practices pointed out as the primary differences. The analysis found that only the Finnish carbon tax produced a statistically significant negative effect on emissions. One explanation for this finding could be that Finland is the only country with no tax exemption or tax relief for their industry. All five countries in the analysis have a national carbon tax with tax rates around 10-30$ per ton CO_2e, the same as most countries with a carbon price scheme in place, except Sweden that has a much higher tax rate, now (2015) close to 130$ per ton CO_2e (Patt, 2015). Since the tax rate was different in all cases, the study argues that high degree of inclusion might be the reason why the Finnish tax had been more successful. Nevertheless, all these results are showing a very limited (if any) mitigation effect and it seems to be consistent with most empirical research on carbon taxes in north European countries (Nyman, 1998). Wier et.al (2005) even speculate that the Danish carbon tax, because it is imposed on energy

[6] Denmark, Finland, Netherlands, Norway and Sweden

consumption in households as well as industry and businesses, has in fact been regressive, leading to undesirable distributional effects. As shown in the study of Australian carbon tax, they resulted in an average 10 and 15 percent increase in electricity prices for households and industry, one would expect that there could be some acceptability problems if countries attempt to impose large carbon taxes in the future.

While the empirical contributions mentioned above have different angles and methodologies, what they have in common is that despite strong theoretical foundations, the effects found are non-existent, highly ambiguous, or at best very weak. It is however, highly likely that market-based instruments work, when the conditions are right, e.g. if tax rates are high enough and there are few tax exemptions. So the right question to ask is perhaps not; do MBIs work or not, but rather; why haven't they worked as indented – and following that, is it likely that these conditions will change in the near future, or are we better off looking at other alternatives to reach stringent environmental goals?

Patt (2015) offers some theoretical insight on the mechanisms that might explain why the market-based instruments seem to have been so ineffective at reducing greenhouse gas emissions. We can trace the first mechanism to political feasibility. A great example is President Clintons energy tax proposal in 1993. Initially the tax proposal was a large and broad-based energy tax that would reduce American dependence on foreign oil imports. It would also reduce domestic CO_2 emission and finally, the tax would be a steady source of revenue to reduce the federal budget deficit. And the proposal had strong support from economists and environmental activists. All this was before political negotiations. Soon after, a range of compromises from various senators and lobby groups forced Clintons ambitious tax proposal on its knees. In order to get it to pass the legislation, the only part of the tax that became law was a 4.3 cents per gallon tax on gasoline. It was quite clear that this tax would do little to reduce emissions, curb oil consumption, or generate much governmental tax revenue. Later, during the George W. Bush presidency, a new bill to establish a cap-and-trade system passed the House of Representatives under the name American Clean Energy and Security Act (ACES) or the Waxman-Markey Bill after its two authors. When Barack Obama became president in 2009, supporters of the bill eyed optimism as the president openly supported the legislation. Over the following year however, the bill got stuck in the Senate. Like the Clinton tax proposal, proponents were not able to gather the 60 percent supermajority needed for bills to pass into law, resulting in the bill being removed from the Senates agenda in 2010. There is reason to believe that similar political feasibility problems might emerge in other places, one example being the short-lived Australian carbon tax previously discussed, lasting only 2 years before it was effectively removed by a newly elected government.

The European Union successfully implemented an emission trading scheme in 2005. The European Emission Trading Scheme (ETS) uses the "cap-and-trade" principle. A cap or limit is set at a total amount of greenhouse gas emission that can be emitted by the participants. One of the key mechanisms is that the total permit cap is decreased over time[7]. Permits can either be given out, a practice called grandfathering, or permits can be auctioned off and later be traded in a secondary permit trading market. The ETS is now in its third phase, running from 2013 to 2020 and covers about 45 percent of EUs greenhouse gas emissions (European Commission, 2016).

After the first[8] and second[9] phase of the ETS, there are some signs that the European policymakers are learning from their mistakes with the European Commission intending to restrict the supply of permits further in later phases. The ETS, now well into phase three can only show to permit prices \$10 per ton CO_2e (2015), but experts hope the restriction in permits can lead to prices of \$40 in 2020 and up to \$70 per ton CO_2e by 2050 (Patt, 2015). But the free fall of permit prices to now barely \$10 is hardly impressive by any account, and

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[7] The ETS cap is decreasing by a factor of 1.74 every year, and from 2021 this will increase to 2.2 percent (European Commission, 2016)

[8] The first phase of the ETS from 2005-2007 can be seen as a trail period. The European Commission gave the member states near complete autonomy over the number of permits and their allocation. Under the pressure from national industry national governments gave out permits for free, causing an excess of permits. This created a fall in demand and permits prices plummeted. In 2007 permit prices were close to zero. According to several studies, the increase in wholesale electricity prices led to substantial windfall profits for utility companies and some of them financed new coal plants that produced cheap electricity at lowest possible costs and would continue to do so as long as permit prices stayed under \$40 per ton CO_2 (Pahle, 2010; Patt, 2015).

[9] Phase two of the ETS started in 2008 and policymakers in Brussels understood that the national incentives to hand out permits to their own industry had to be restricted. This led to new legislation that decreased the total number of permits and a modified ETS that relies more on permit auctions.

most experts would argue that prices need to be much higher to change behavior and systemic change.

The common feature of environmental taxes and emission trading schemes is that they entail some form of lost profits and change of practice. If the industry and actors feel that these interventions are too invasive, in form of unfair distribution or rapid implementation, one would expect the industry to engage in evasive maneuvering, e.g. outsourcing, leading to carbon leakage and increased lobbying (Cho & Tobin, 2010). This view is further supported by Daugbjerg & Svendsen (2003), arguing that in general, companies are likely to oppose environmental taxes because they will have to pay both the tax and the abatement costs. For nearly all of the historical examples of the use of market-based instruments, the reoccurring theme is that they have not been ambitious enough to make a difference. This lack of ambition reflects the seemingly troubling political reality. Carbon markets and taxes create a very direct economic effect, which is mostly negative, while the positive effects are harder to trace. The way carbon pricing affects markets will according to Patt; "translate directly and immediately into higher energy prices" (Patt, 2015 p. 81), as seen in the case of Australia, where utility companies answered a carbon tax with higher wholesale electricity prices.

Additionally, when trying to measure the real effects of market-based instruments and how ambitious they have been, one has to take into account the natural advances in technology and efficiency over time. Sometimes companies invest in new and improved technology, that also happen to be much more clean and environmentally friendly, just because it makes economic sense. An example being when the land-based gas industry moved from single cycle gas turbines to combined cycle gas turbines (CCGT). The new CCGT increased the gas conversion efficiency by over 50 percent, with an additional effect of reduction in emission from exhaust gas by 25-30 percent (Christiansen, 2001). It really made economic sense to make the shift to this new improved technology, perhaps for the most part because of the increase in efficiency, although the reduction in emission was a welcomed side effect. Another example is the shift from coal and oil in Swedish district heating to biomass from forest and forest industry. With nearly every city using district heating, proponents of the Swedish carbon tax would argue that this would not have happened without the tax. However, as Patt points out, the real causal link between the shift and the carbon tax is ambiguous at best. It might have contributed to a push toward cleaner heating, and it certainly could have promoted district heating with biomass as an alternative for cities that did not have this type of heating system in place, but the reality is that the shift from coal or oil to biomass makes economic sense even without the tax (Patt, 2015).

The second mechanism has to do with institutions, or rather the lack of them. John S. Dryzek (2013) describes the attempts of international agencies and organizations like the OECD, IMF, the World Bank, and European Environmental Agency (EEA) to push for market-based policies, chiefly among them, a global CO_2 tax. Yet these policies are seen far and few between and regulatory policies, such as technology or emission standards are still dominating the policy landscape. According to Dryzek, one explanation for the lack of impactful market-based policies lies in the simple inertia of established institutional practices, mainly resistance to change of established routines. Patt (2015) also argues that institutions are part of the explanation why market-based instruments have largely failed and will most likely never be implemented at the level needed to really curb greenhouse gas emissions. He argues that the world lacks institutions that would be necessary for an effective global tax or emission trading scheme. Such an institution has to be as influential as the World Trade Organization is for global trade, and that the establishment of mutual trust and common principles would most likely take generations to build, an unlikely endeavor within the timescale needed to solve climate change.

To summarize, while environmental taxes and cap-and-trade are in theory, the most optimal way of curbing emissions at the lowest possible cost – they rely on certain assumptions and conditions in order to function properly. Tax rates need to be high and there cannot be many exemptions in order to influence investment and change behavior. As for the emission trading schemes, one would certainly expect industry and business to resist a cap level that is ultimately needed to reach our climate goals – meaning at some point zero, which will eventually put them out of business. So when these market-based instruments meet political reality, they are in some cases defeated completely, or implemented with an ambition level that is too low to make a difference.

Since the theoretical arguments and the empirical evidence are contradictory, there is no clear expectation of the casual connection between the use of market-based instruments to reduce greenhouse gas emissions. Therefore, I have decided to construct two main hypotheses, one that build on the theoretical mechanisms found in the environmental economy literature that:

H1: *Environmental taxes have led to a reduction in greenhouse gas emissions.*

And a second hypothesis derived from the results of empirical studies and the feasible explanatory mechanisms described by Dryzek and Patt presented in the chapter above:

H2: *Environmental taxes have had little effect on greenhouse gas emissions.*

Looking at alternative policy approaches to reduce greenhouse gas emissions, the literature offers us two other approaches, the proponents of these approaches argue that market-based instruments only leads to tinkering at the margins and do in fact, not lead to the systemic change needed to transition society into a low carbon future. These approaches advocate research and development (R&D), and the rapid diffusion and implementation of the advances in these green and environmentally friendly technologies at the core of climate policy.

2.6 Governmental R&D expenditure

OECDs Frascati Manual defines research and development (R&D) as a term covering three activities: basic research, applied research, and experimental development (Frascati Manual, 2002). And while the direct link between governmental funded R&D and reduced emissions is not easily established, as R&D itself does not magically reduce our emission, we can assume that there could be an indirect relationship. As new and immature technology is usually expensive to research, develop and demonstrate, governments can help to mitigate some of the risk and uncertainty surrounding costs for such projects, especially in the early phases. Governmental R&D funding also has the potential to promote advances in already existing technology that can prove vital in the battle against climate change. There are also several arguments for that governmental R&D funding is a prerequisite for innovation and competiveness. In that case, the strategic use of governmental R&D funds would not only increase competiveness for green technology and industry, it would also be a way to meet climate commitments.

Some evidence for this link can be found in Mariana Mazzucatos book *The Entrepreneurial State* (2013). It is one of the most read-about books on the state and innovation to come out in the past decade or so. Here she argues that some of the most impactful and outreaching innovations in the world, such as the railway system, the internet and even the Apple iPhone, either relied on technology that the government had in large part funded or would not have been realized without the active role of the State. Thus, she argues that governmental R&D funding and an active State will play a key role in the development of the green technology that is needed to reach stringent climate goals. According to Mazzucato, the “green industrial revolution” being pushed by the State around the world should be viewed as an attempt to transform the massive existing energy infrastructure and in reality that entails policies on both the demand and supply side, meaning there is a need for policy to reduce consumption of fossil fuels on one side while having policy to aggressively promote cleaner alternatives on the other. Thus, governmental R&D funding can be critical for advances in both the demand and supply side of energy, energy efficiency, and environmental protection.

In fact, there are not many studies that look at the link between R&D expenditure and emission reduction. Cho & Tobin (2010) find in their quantitative study of 26 OECD countries from 1995 to 2005 that increased public funded R&D for care and control of the environment have significant effect on reducing GHG emissions. They conclude that it is much easier to increase R&D expenditure compared to enforcing harsh environmental taxes on firms, which leads them towards evasive maneuvering and increased lobbying. In another study, Lin & Li (2011) find in their analysis that:

> “industry structure, international oil price and gross domestic expenditure on R&D are found to have negative impacts on the growth of per capita CO_2 emissions, which suggests that accelerating adjustment of industry structure, raising energy price and increasing expenditure on R&D, all contribute to the reduction of the growth rate of CO_2 emissions” (Lin & Li, 2011 p.5141).

Although Lin & Li use gross domestic expenditure on all types of R&D in their analysis, it is one of the few studies, together with Cho & Tobin that explicitly analyze R&D indicators against emission data.

Historically, few countries have actually engaged in energy and environmental related R&D activities, as shown by the fact that in the start of the 1980s, nine OECD countries[10] accounted for about 95 per cent of the worlds public sector funding of energy related R&D. However, in the period between 1985 and 1995, these countries cut their spending on average with 20 percent (Dooley & Runci, 1999). In this period, statistics show that US federal funding for energy R&D dropped dramatically, and soon after the number of patens involving wind, solar and nuclear plummeted, which could be an indicator of how important these federal funds had been to companies and start-ups (Sivaram & Norris, 2016).

OECD assessment of governmental R&D appropriation budgets show that the financial crisis and following slow recovery has negatively impacted R&D appropriations in the years following the crisis. From 2008 to 2012 OECD countries cut all R&D expenditure by almost half to a gross expenditure of 1.6%, compared with the years 2001-2008. The report highlights austerity measures and fiscal consolidation as contributing factors to the considerable reduction in green R&D budgets (OECD, 2014). At the present time, China is one of the major drivers in R&D expenditure, almost doubling its budget in the period after 2008. In addition to China, there seem to be a trend in emerging economies that investing in R&D yields results in both competitiveness and innovation. In the US, during Obamas first term, environmentally related R&D funding increases significantly through the ARRA (American Recovery and Reinvestment Act) stimulus package in 2009. This was followed by budget appropriations for 46 new research centers called Energy Frontier Research Centers (EFRCs) in 2010, with budgeted financial backing until 2020 (Moe, 2015). For the European countries, the trend shows a clear divergence, with some countries fulfilling their R&D commitments, while others are lagging far behind (OECD, 2014). In Norway the Stoltenberg Government invested heavily in R&D for Carbon Capture and Storage (CCS) technology development at Mongstad in Western Norway. The Technology Center Mongstad (TCM) is the world's largest facility for testing and improving CCS (TCM, 2010) and was coined the Stoltenberg Government's equivalent of the Moon landing (Office of the Prime Minister, 2007). The facility received millions in federal funding, without significant results as of yet,

[10] The nine countries were the United States, Japan, Germany, the Netherlands, United Kingdom, France, Italy, Canada, and Switzerland (Dooley & Runci, 1999).

the “moon landing” was cancelled in 2014 due to high costs (Ministry of Petroleum and Energy, 2014a). The facility is however still operative with some R&D activity, in hopes of breakthroughs (Teknisk Ukeblad, 2016).

As the advances in green technology (green-tech for short) is now seen by most countries as a promising new business opportunity, governmental R&D commitment is seen as an integral part of such a strategy. In 2010, Obama called on the US to become a dominant player in clean energy, arguing that the country would be foolish to give away future clean jobs to Germany and China (Moe, 2015). With the US being particularly well positioned for a clean energy transition, being blessed with exceptional wind, solar, and hydropower conditions in various parts of the country. In OECD’s biannual review of key trends in science, technology and innovation (STI) policy; The OECD Science, Technology and Industry Outlook argue that;

> “reducing global greenhouse gas (GHG) emissions and protecting environmental assets will require innovation and the large-scale adoption of green technologies. Without innovation, it will be very difficult and very costly to sustain current growth trajectories while addressing major environmental issues such as climate change” (OECD, 2012 p. 216).

In November 2015 a new global clean energy R&D initiative called Mission Innovation was announced with an objective of funding the clean energy technology of tomorrow:

> “In support of economic growth, energy access and security, and an urgent and lasting global response to climate change, our mission is to accelerate the pace of clean energy innovation to achieve performance breakthroughs and cost reductions to provide widely affordable and reliable clean energy solutions that will revolutionize energy systems throughout the world over the next two decades and beyond” (Mission Innovation, 2016).

Currently 20 counties, including the US and China, and the European Union is participating with a goal of doubling its governmental clean energy R&D over the next five years as well as a close connection with the private sector and business leadership with goals for implementation and information sharing (Mission Innovation, 2016).

As mentioned with the example of the Mongstad CCS test facility, the need for early capital investment and risk mitigation is perhaps most apparent in the case of carbon-capture and storage (CCS). IEA counts on CCS to be a key abatement technology and will require significant R&D expenditure from both the private and public sector. In all the sub-business-as-usual scenarios, CCS technology is expected to be installed on coal and natural gas power plants around the world, in various degrees. In IEAs 2C-scenario CCS accounts for 20 percent of the cumulative CO_2 reduction by 2050. Although CCS is seen as an integral part of any scenario that keeps climate change manageable, there is a worrisome lack of progress in cost reduction and technology development. The technology works, as demonstrated at the Boundary Dam coal fired-power plant in Canada, the world's first commercial-scale CCS plant. There are also two CCS installations in the North Sea, on the Sleipner west field and Snøhvits LNG plant at Melkøya, as well as a CCS project at the In Salah gas field in Algeria (IEA, 2012; IEA, 2013; Goldenberg, 2014; Statoil, 2013a; Statoil, 2013b; Statoil, 2015a). However, the technology still relies on potential problematic factors like the need for favorable geological locality for injection, installation, and operating costs, in addition to potential problems of social acceptability[11].

So although it is hard to disclose a direct causal connection between R&D expenditure and GHG emission reduction, there is credible reason to believe that the investment in R&D at least indirectly leads to reduction in GHG emissions. As new technology is often expensive to develop, governments are especially suited to invest early in R&D projects, as they provide much needed capital support. While increased governmental expenditure on environmental R&D lacks a strong theoretical foundation, studies have shown that there is a relationship between increased R&D expenditure and reduced emissions. It is also reasonable to think that R&D expenditure can increase a country's competiveness and is by many viewed as prerequisite for innovation. In this way, public R&D funding can be a way for

[11] As CCS generally means CO_2 injection, a favorable injection location is preferable for any CCS project. This can lead to problems of social acceptance, as the CO_2 injected into the ground could potentially be dangerous. Shells CCS project in the Netherlands illustrates some of these potential problems. The projects proposed injection site was a depleted gas field under the town of Barendrecht in Netherlands. Despite being deemed safe by experts, the project was cancelled in 2010, after public outcries, a reminder that projects like this can result in "not-in-my-backyard" (nimby) protests (Limousin, 2010).

governments to position their country in new green-tech and renewable industry, while at the same time fulfill climate commitments, leading me to the following hypothesis:

H3: *Increased public spending on environmental R&D leads to reduced greenhouse gas emissions.*

2.7 Technology and innovation enhancing policy

Anthony Patt (2015) argues that the most important debate in climate policy right now is deciding on whether we implement policy that supports and promotes new technologies or policy that penalize the old ones. It's simple carrots versus sticks, and according to Patt the prevalent discourse in climate policy has been primary focused on the latter. Market-based instruments like cap-and-trade and carbon taxes are both built around sticks, rather than carrots. He argues that the dynamic nature of energy transition needed to shift from fossil fuels to renewables will likely result in carrots being at least as effective as sticks. And even if they are not as efficient and cost effective as MBIs are in theory, "an inefficient policy that gets us decarbonized is better than an efficient one that fails to do so. Simply put: carrots get you creative innovation; sticks don't" (Patt, 2015 p. 280). Moreover, renewable energy has additional benefits; they protect the climate and relative to fossil fuels they also protect local air quality, a problem that is increasing dramatically in large cities. In some cases, they also protect water resources. As countries get wealthier, the populations' awareness of environmental hazards such as air pollution increases. An estimated 5.5 million people die annually due to low air quality worldwide (Amos, 2016), most of them in China and India. These dramatic social costs are expected to influence future policy decisions. This is perhaps most apparent in China, where we are starting to see a scale back of new coal-based power plants (Gardner, 2014).

As policymakers seek to implement policies designed to reach stringent emission reduction targets and keep pollution at non-harmful levels, an alternative approach is to actively implement technology policy that aim to support the diffusion of new and environmentally friendly technology. A definition of diffusion can be provided by the Schumpeterian trilogy for technological change: "Invention (the generation of new ideas), innovation (the development of those ideas through to the first marketing or use of a technology) and diffusion (the spread of new technology across its potential market)" (Stoneman & Diederen, 1994, p. 918). Until recently, policy in OECD has tended to focus on the invention and innovation, or science and R&D, and less on diffusion, although this trend is starting to shift (Stoneman & Diederen, 1994; OECD, 2007).

There are examples of aggressive technology policy that aim to promote the rapid diffusion and implementation of new technology, while at the same time stimulate new innovation and cost reduction. In relation to deployment of renewable energy, the most dominant of these polices have been feed-in-tariffs (FIT). The political objective of FIT is to make renewable technologies cost-competitive – before regular market forces take over (Alizamir, de Véricourt & Sun, 2016). In a 2008 report from the European Commission it is stated that: "well-adapted feed in tariff regimes are generally the most efficient and effective support schemes for promoting renewable electricity" (European Commision, 2008). In 2008 FITs were installed in 63 jurisdictions worldwide (Couture & Gagnon, 2010).

FITs are generally built around a few selected technologies[12] that a government wants to promote. FIT is therefore, not a technology-neutral policy. FITs usually contain three mechanisms that promote the diffusion of selected technology and mitigate investor risk. These are; guaranteed grid access, long-term contracts, and cost-based purchase price. Guaranteed grid accesses ensures power producers who invest in the new technology a mechanism to sell excess power back to the grid. The long-term contracts usually range between 10 and 25 years, thus creating long-term stability for investors. As FITs have cost-based purchase price, the government needs to estimate the price of producing electricity to set the tariff. The standard way estimating the price on production of electricity is the levelized cost of electricity (LCOE). This estimate is also used to compare different technologies (e.g. the LCOE of coal versus solar PV at any given time). The LCOE can vary greatly from country to country, on a sessional basis, even different hours of the day. The government needs to identify the expected cost of producing power (the projects LCOE) with each technology at the current time and update these on an annual basis. This estimation method needs to consider differences in configurations such as size and deployment location, like rooftop or ground solar panels or inland or offshore windmills. The government then puts

[12] In most cases of implemented FITs, the supported technologies have been solar PV and/or wind.

a premium in addition to the estimated project LCOE to give a small profit to people or companies that invest in these technologies. Thus, the estimated LCOE and the premium set the tariff for any excess electricity sold back to the grid. The combination of stability and predictability for investors are seen as key elements for successful FITs (Patt, 2015).

Perhaps the most famous example of the implementation of feed-in-tariffs is Germany, under its *Energiewende*-policies[13]. Germany may serve as a real world example of how technology policy can promote renewable energy installation, if the government is committed to making at the time very tough and unpopular political choices. In hindsight, there is little doubt that the German FIT has been expensive, and there is every reason to believe that the regular German taxpayers have paid for it. That being said, it has contributed enormously to the deployment of renewable capacity in Germany, and as a result – to the cost reduction in solar PV. The cost of solar PV has dropped over 90 percent in the last decade, a dramatic drop that would not likely have happened without the German FIT scheme (Patt, 2015).

According to Couture, Cory, Kreycik & Williams (2010) in the European Union alone, FIT polices have led to a considerable deployment of renewables, with "more than 15,000 MW of solar photovoltaic (PV) power and more than 55,000 MW of wind power between 2000 and the end of 2009" (Couture et al., 2010 p. 5). In 2010, it is estimated that FITs are responsible for about 75 percent of solar PV and 45 percent of wind deployment globally. FIT policies are becoming an attractive alternative to market mechanisms such as carbon taxes, cap-and-trade, and even renewable portfolio standards[14] (RPS), with Germany setting a powerful example of how an industrialized country can use FITs to drive renewable energy deployment while meeting emission reduction targets and better energy security.

Analysis of FIT schemes show that their success or failure depend critically on the tariffs which government decide to buy green electricity. How well these tariffs are adjusted over time in light of new information and technological advances, will in turn determine the profitability of investments. Very aggressive tariffs generally increase profitability, but make less efficient projects viable at extra cost for taxpayers. Too conservative tariffs on the other hand can lead to limited deployment of technology because only the most efficient projects

[13] In 2017, Germany is scheduled to move away from FITs towards other policy approaches.
[14] Renewable portfolio standards (RPS) is a form of regulation that mandate utility companies to provide a set amount or percentage of power from renewable energy sources as a portion of their production (Rabe, 2006).

are financially viable (Mendonça, Jacobs & Sovacool, 2009). Additionally, cost-reduction following technological learning curves gives investors an intrinsic incentive to delay investment. To overcome this, Alizamir et.al (2016) argue that regulators can focus on a policy-design that reduces some of the incentives for investors to postpone their investment.

As more and more countries experiment with FIT policies, a realistic expectation is warranted. There is still a long way to go in order to drastically reduce our dependence on fossil fuel generated electricity. In 2015, 60.3 percent of electricity generation came from combustible fuels in the OECD. Of the remaining production, 18.3 percent came from nuclear, 13.9 percent from hydro, and 7.6 percent from solar, wind, geothermal and other renewables, with the latter experiencing a 16 percent increase in generation compared with 2014 (IEA, 2016b). Our dependence on fossil based energy depends largely on the advances and diffusion of alternative energy sources, that in time will have to replace our current energy system if we are to keep emissions under the safety limit estimated in various climate scenarios.

Both in solar and wind technology some optimism is justified. The average windmill turbine installed in Europe in 2015 was 4.1 megawatts, a 28 percent increase since 2010. Experts now predict that 6.8 megawatt turbines to be the norm in 2020[15]. As next generation wind turbines and wingspan get bigger and wider, their efficiency increase dramatically. Global wind installment capacity (2016) is now 63.5 gigawatt, producing about the same amount of electricity as 63 nuclear reactors, resulting in wind being the most installed form of low-carbon energy production in the world, hydro excluded. Bloomberg New Energy Finance analyst Tom Harries predicts that the doubling in turbine size in this decade will reduce the number of turbines needed in 2020 compared with 2010, and will in turn translate into fewer foundations, less cabling and simpler installation, resulting in cost-reduction for the wind industry (Shankleman, 2016). Advances in solar PV is perhaps more astonishing than the progress of wind. As mentioned, solar PV prices have dropped 90 percent over the last ten years, and are showing a cost-reduction of around 10 percent annually as advances in materials, software and installations drop significantly. Deutsche Bank's leading solar analyst

[15] The world's most powerful turbine is located in Denmark and is currently at 8 megawatts, enough to power 4000 homes.

Vishal Shah predicts that solar PV will be at grid parity in most countries in the world by the end of 2017, a major benchmark for the technology (Parkinson, 2015).

Another example of a technology policy is electric vehicles (EVs) subsidies. To stimulate growth and technology advances in EVs, some governments have decided to subsidize car buyers that chose to purchase EVs, either as subsidies on retail price or through tax exemptions. EV subsidy policy have been both applauded and criticized. On one side, proponents say that these policies have been vital for the cost-reduction and advances in battery technology and without any market-penetration EVs will not compete with combustion engines for decades. On the other side, critics would argue that EV subsidies can create incentives for high income families to purchase a second car, more driving at the expense of public transport and bicycling, and that without a larger renewable electricity generation, EVs are running on fossil fuel generated electricity (Holtsmark & Skonhoft, 2014).

So while market-based instruments provide the strongest theoretical argument for the most effective way to reduce emissions, technology and innovation supporting policy has arguably provided us with the best practical examples of effective emission reduction. Technology polices like feed-in-tariffs and electric vehicle subsidies aim to make renewable energy and electric vehicle technology cost-competitive with current fossil-based electricity production and vehicles powered by gasoline or diesel. The rapid diffusion of these technologies can lead to cost-reduction from technological learning curves and create new innovate solutions to solve problems relating to climate change. I therefore construct the following hypothesis, that:

H4: *Technology and innovation policy lead to reduced greenhouse gas emissions.*

3 Method

3.1 Dataset and collection of data

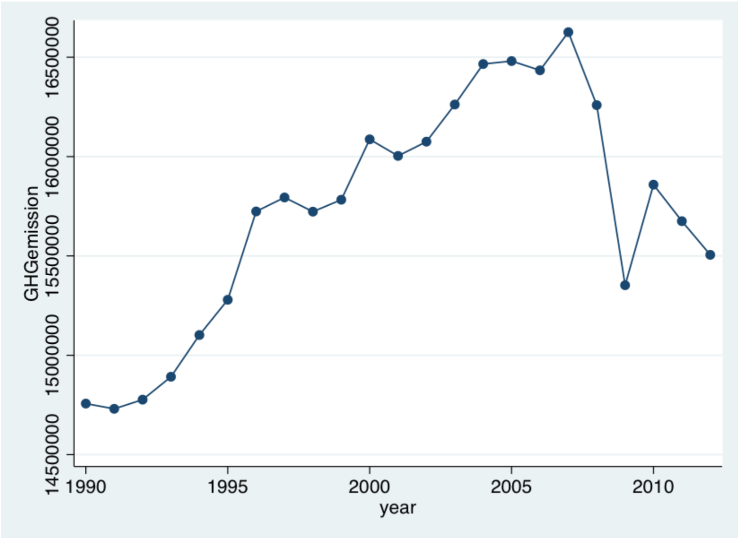
The quantitative data in the statistical analysis are gathered from two statistical databases: the OECD.Stat database (OECD.Stat, n.d) and from the World Development Indicators database produced by the World Bank (World Bank, n.d). Relevant indicators have been examined and collected by the author from these two sources. Variables vary from emission data to economic and demographic data such as environmental taxes, R&D expenditure, economic growth and urbanization. The dataset also contains technological and industrial indicators such as a constructed innovation variable, as well as manufacturing and renewable energy consumption. As the dataset is constructed for this project from these various sources, I have included the dataset in its entirety in Appendix D, to ensure the highest degree of transparency.

3.2 Dependent variable: Greenhouse gas emission

The aim of the statistical analysis is to test the effect of different policy approaches to see how effective they have been to reduce greenhouse gas emission in the OECD. As described in the quick overview of the climate science, the standard measurement is million or thousand tonnes of CO_2 equivalent. The dependent variable chosen in the quantitative analysis measures man-made emissions of major greenhouse gases and emission by gas from all OECD countries excluding Chile and Israel[16] from 1990 to 2012. The data refer to total emissions of CO_2 (emissions from energy use and industrial processes, e.g. cement production), CH_4 (methane emissions from solid waste, livestock, mining of hard coal and lignite, rice paddies, agriculture and leaks from natural gas pipelines), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6), measured in thousand tonnes of CO_2 equivalent[17]. The OECD database collect their data from the National Inventory Submission 2014 to the United Nations Framework Convention on Climate Change (UNFCCC, 2014a). It is also important to keep in mind that these data are *gross direct emissions*, thus emissions or remove of greenhouse gas emission from land-use, land-use change or forestry are excluded. (OECD.Stat 2015a). Figure 1. shows the sum of annual OECD greenhouse gas emissions[18].

[16] Chile has missing data from most of the independent variables and Israel is missing data on the dependent variables, and on that basis excluded from the analysis.
[17] Under Reporting; General Guidelines – Estimates of emissions and removals: Article 12, paragraph 1(a), of the Convention requires that each Party shall communicate to the COP, through the secretariat, inter alia, a national inventory of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. As a minimum requirement, inventories shall contain information on the following GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) (UNFCCC, 2014a).
[18] All OECD countries (included Chile), Israel excluded. GHG emission estimates.

Figure 3. Total Greenhouse gas emission OECD 1990-2012 in thousand tonne of CO_2e



Emission data is measured in thousand tonne of CO_2 equivalent (CO_2e) and show that emissions peaked around 2007 at over 16.5 gigatonnes[19] of CO_2e[20]. As the financial crisis hit most sectors, emissions dropped in both 2008 and 2009. In 2010 emissions rose again, but have dropped steadily since then.

With the amount of quantitative data produced by the OECD and other statistical databases, it leaves the responsibility with the researcher to ensure that the chosen variables measure what we want to measure and is of the highest possible quality (Ringdal, 2013). Using OECD statistics arguably ensures a high degree of quality. However, there could be a problem of different measuring procedures, and factors like transparency and accuracy when it comes to reporting GHG emission data from different OECD countries. There is certainly the chance of reporting error from the different countries that have to be taken into account when evaluating the quality of these data, given that the GHG emission data are based on estimates (Ringdal, 2013). Lastly, comparing the OECD emission data with the rest of the world could lead to problems, namely because of potential differences in the number of gases included, the measurement quality and estimate accuracy in comparable databases.

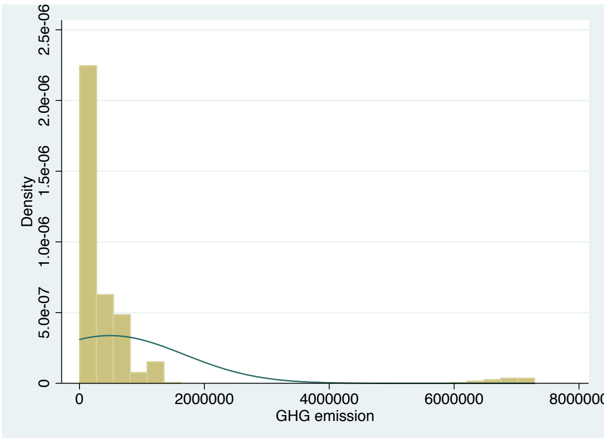
[19] The tonne (British or SI) or metric ton (US) is equal to the mass of 1000 kilogram. One gigatonne is 10^9 million tonnes or 1 billion tonnes.
[20] For reference, humans emit between 26-29 gigatonnes of CO_2 each year, and 40 percent of this is absorbed by natural sinks, such as the oceans and vegetation (Tripati, Roberts & Eagle, 2009).

Table 1: Detailed descriptive statistics for the dependent variable

Variable	N	Mean	Std. dev.	Min	Max	Skewness	Kurtosis
Greenhouse gas emission	733	489629.1	1182167	3275.95	7287750	4.817	26.030
Log Greenhouse gas emission	733	11.930	1.522	8.094	15.802	-0.001	3.152

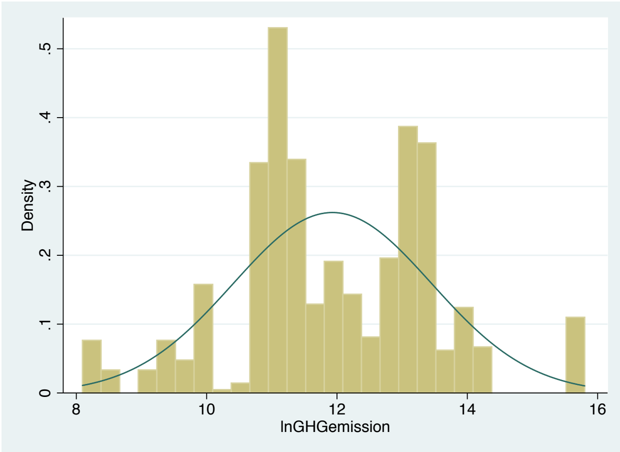
Dealing with countries that are different in size, population and various other factors can lead to deviation from a normal distribution. As we can see from the skewness and kurtosis values in table 1, and the graphical representation of the dependent variable shown in the histogram in figure 1. the distribution is clearly skewed and very pointy. The most common way to deal with this problem is to log transform the variable, this usually makes a skewed distribution more normal distributed.

Figure 4: Histogram of GHG emission



As we can see from the both the values in table 1 and the difference from figure 4 to a log transformed variable shown as a histogram in figure 5, the variable is now approximately normal distributed. The log transformed dependent variable changes slightly the way we interpret the coefficients, so this has to be taken into account in the analysis (Christophersen, 2013). The new dependent variable is called: *Log GHG emission* in the analysis.

Figure 5: Histogram of log GHG emission



3.3 Independent variables: Environmental tax, R&D expenditure and Technology diffusion

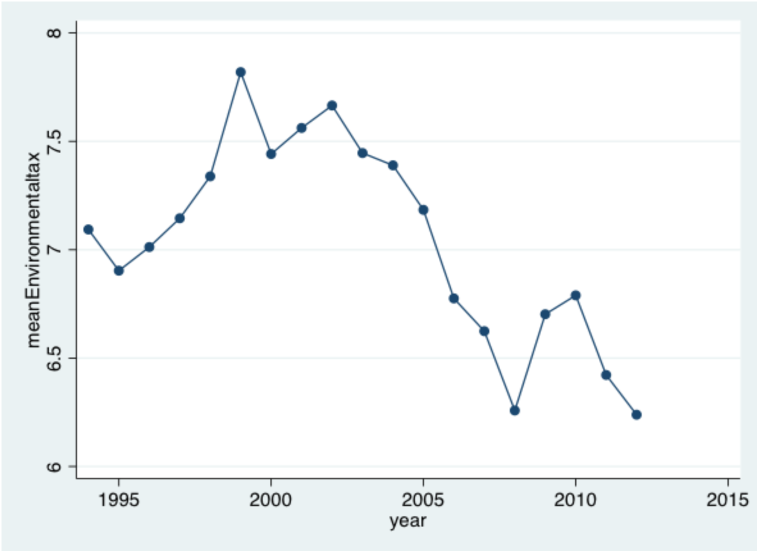
3.3.1 Environmental tax

The environmental taxes variable is collected from the OECD statistical database. The data have been developed in a cooperation between OECD and the European Environmental Agency (EEA). The database contains environmental policy related information, such as taxes, fees, tradable permits and green subsidies. The environmentally related taxes are an important MBI for governments to regulate behavior and generating additional tax revenue. The characteristics of these data are constructed in a way that they represent the tax revenue generated from the environmental domain. In addition, the data have been cross-validated with statistics using the OECD Tax database and official national sources (OECD.Stat, 2015b). The variable is constructed to measure tax revenue generated from environmentally related taxes[21], as a percentage of total tax revenue. There are no data for environmental taxes from 1990 to 1994, and I will discuss how I deal with this break in the time series later in this section.

Figure 6 shows the mean environmental tax in OECD for each year from 1994 to 2012. We can see that the OECD average is between 6 and 8 percent. Turkey has by far the highest environmental tax revenue percentage in the OECD, over 22 percent at one point, with revenues coming mostly from heavily taxed motor fuel (OECD, 2008).

[21] Environmentally related tax is the sum of three subgroups; tax on energy, motor vehicles and other.

Figure 6: Mean environmental taxes in OECD 1994-2012



The lowest measurements, - 7.5, - 6.7 and - 4.4 all come from Mexico, coming from implicit energy subsidies when oil prices were on a world high, resulting in negative environmental tax (OECD, 2013). An interesting note is that the mean tax rate has actually gone down, almost 1.5 percent since it peaked around 1999. Being proposed as the obvious policy approach, one would perhaps expect a different trend. The variable has missing data from 1990-1994 for all countries as well as 3 missing observations, resulting in a total of 131 missing values. Apart from a few negative measurements in a short time span in Mexico, most OECD countries generate a fair amount of tax revenue from these taxes. While revenue statistics should be fairly objective, there can be some problems relating to how well the OECD defines "environmentally related taxes". As a consequence, faulty reporting procedures might produce inaccurate estimates of tax revenues. However, I would argue that the cross-validation of data in the database should ensure a reasonable degree of protection against such problems. In the analysis the variable is called: *Environmental taxes*.

3.3.2 R&D expenditure

The R&D expenditure variable is collected from the OECD statistical database, with data registered as million US dollar (PPP dollars, current prices) (OECD.Stat, 2015c). The data is constructed by the OECD after Government appropriations or outlays for R&D (GBAORD) by socio-economic objective (SEO), using the NABS 2007 classification[22]. The relevant NABS classification for this analysis is the NABS02; Environment, sorting R&D appropriations or outlays for; the control, identification and causes of pollution that effect man, species and biosphere; Development of monitoring facilities for the measurement of all kinds of pollution and elimination and prevention of all forms of pollutions in all types of environments (Eurostat, 2008). The variable is constructed as R&D expenditure on environmental protection, as percentage of total R&D public budget. While it would be very interesting to add energy R&D into this variable, it was not possible to decouple fossil-related energy R&D from clean energy R&D from the OECD.Stat database. And while this is an obvious weakness for the R&D variable, I would argue that it is likely that most countries have spent more money on fossil-related energy R&D than clean energy related R&D. And if this is the case, it would lead to some unwanted bias in relation to the interpretation of the variable in the model. On these grounds I have therefore decided to not include energy R&D to the variable. I have however included a model to Appendix B, with energy R&D included into the R&D expenditure variable as a control measure to see how it would affect the regression results.

The OECD average on environmental R&D expenditure is just over 2 percent and when examined graphically, it shows a slightly downward trend in the OECD after 2007. Before 2005, no OECD country had over 5 percent of the total R&D expenditure devoted to environmental related programs. In 2005, Hungary devoted 10.7 percent of its R&D expenditure on environmental R&D, as well as some more countries devoting over 5 percent of their total R&D budget, pulling the OECD mean upwards. Another outlier in the R&D data is New Zealand, from 2006 to 2009 they devoted over 16 percent of their R&D expenditure to environmental related R&D programs. Since 2010 environmental related R&D ranks fourth in the overall R&D expenditure statistics, behind manufacturing, primary industries and health (Statistics New Zealand, 2013). While some places like New Zealand are heavily committing to R&D, the data from the OECD reveal that over 30 percent of the

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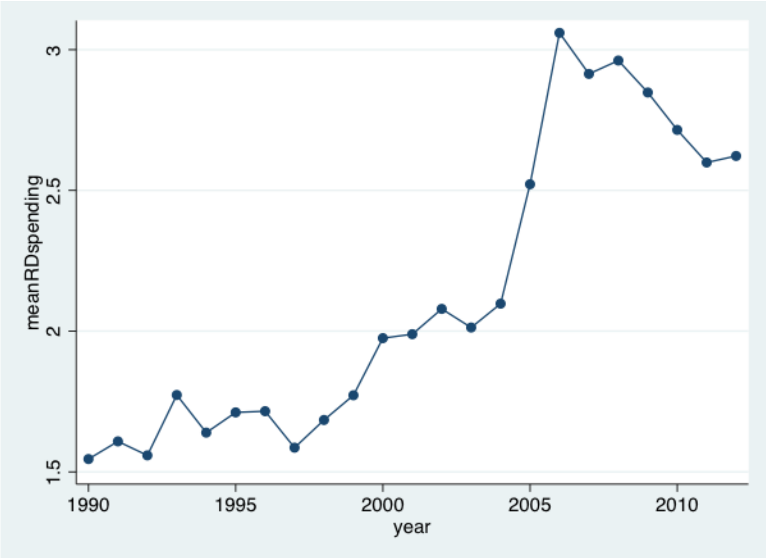
[22] NABS stands for: Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets and is divided into 14 specific classifications.

measurements are under 1 percent. This tells a tale of lacking commitment to environmental R&D in the total R&D budget within the OECD.

Figure 7: Mean environmental R&D expenditure in OECD 1990-2012



Looking at Figure 7 it shows that R&D expenditure has steadily increased over time within the OECD as a whole, nearly doubling since 1990. However, as pointed out earlier, R&D budgets around the world took some serious hits after the financial crisis. This is shown in the downward trend after 2007 in the figure. And while New Zealand still committed over 17 percent of their total budget to environmental R&D in this period, it has not been enough to offset the general downward trend. Although overall mean R&D expenditure has only gone down 0.5 percent in this time period, it accumulates to many million dollars. Especially as R&D commitment is seen as a prerequisite for innovation and growth, one would expect to see the opposite trend in the data. The variable has a total of 127 missing values, and have therefore included a control measure in the model, like with environmental taxes, which I will further elaborate on later in this section. In the analysis this variable is called: *R&D expenditure*.

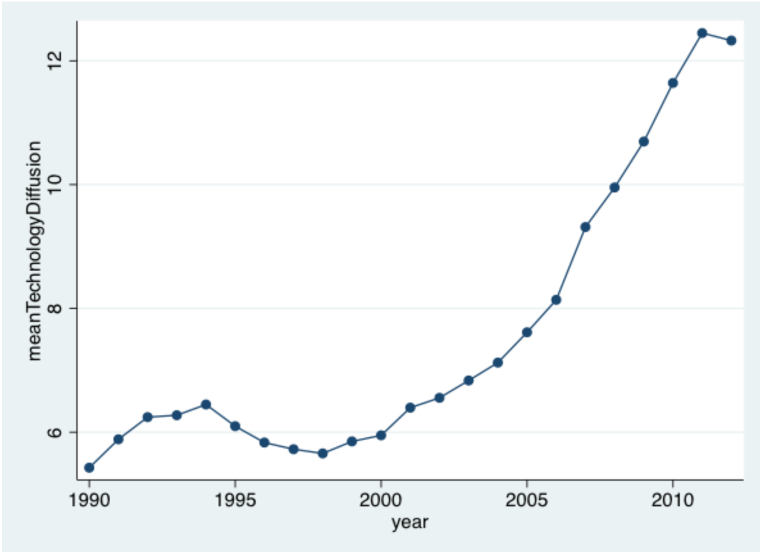
3.3.3 Technology diffusion

The variable is collected from the OECD statistical database (OECD.Stat, 2015d). The data are generated by the OECD Environment directorate together with the Directorate for Science, Technology and Innovation. As the data represent a patent-based innovation indicator it allows for analysis of countries' and firms' innovative performance and governmental environmental innovation policies. The patent statistics are extracted data from the Worldwide Patent Statistical Database (PATSTAT) of the European Patent Office (EPO) by the OECD. The variable in the analysis is constructed using the total number of patents submitted to national patent office and an aggregated category labeled "selected environmental-related technologies" ranging from technology relevant to environmental management, water-related adaption and climate change mitigation (OECD.Stat, 2015d). Thus, measuring selected environmental technology patents, as percent of total patents submitted to national patent office.

The use of patents statistics is mostly seen in econometrics (see for instance Pavitt, 1985; Griliches, 1990; Johnstone, et al, 2012). There are also many who believe that patent statistics is an inadequate measurement for innovation or rate of technological change. According to Hall (2013), patent statistics are desirable because they are an objective measurement, but assuming they are a stable measurement of innovation is not advisable. So rather than using the patent data as a measure of innovation per se, I will use it as a proxy measurement for technology diffusion from the environment domain. In other words, using the OECD definition – to provide the analysis with a proxy measurement of how successful OECD innovation and technology policies have been to promote diffusion of environmental related technologies. It is important to note that I have chosen to use patent data classified as technology diffusion, over patent data classified as technology development. There are some trade-offs here, and while technology development includes statistics about technology development coming from the private sector, I believe that technology diffusion will also measure this dimension and can actually be a more refined measurement, since diffusion, by definition are technologies that are ready to enter their respective markets. I would also argue that the technology development indicator can be too closely related to the R&D indicator that I already have in the model.

From the descriptive statistics the OECD average is about 7.5 percent of total patents submitted. The highest percent are submitted in Luxembourg and Iceland. Iceland has a very high proportion of total energy consumption covered by renewable energy, mainly from geothermal energy. According to the national energy department, Iceland is a pioneer in using geothermal energy for space heating (Orkustofnun, n.d).

Figure 8: Mean technology diffusion in OECD 1990-2012



As Figure 8 shows, there is a clear upward trend in submitted environmental related patents in the OECD. Since 1990, the mean of submitted patents has more than doubled, to over 12 percent of total submitted patents. This should also be seen in context of the probability that the demand for environmental related technology also increased in the same period, thus giving these types of technologies a market to expand. The variable has 21 missing values. In the analysis the variable is called: *Technology Diffusion*.

3.4 Control variables

In order to measure the unique effect of the different policy approaches it is important to control the effect with other suitable control variables that might also influence the rate of emission. The first of these is a control for renewable energy consumption. It is obtained from the World Development Indicator database, and the data are based on IEA World Energy Balances (World Bank, 2016). It measures renewable energy consumption as percent of total final energy consumption. Controlling for various rates of renewable energy consumptions in the OECD countries is arguably one of the most important variables to include to see the unique effects of the main independent variables on GHG emissions. *I expect that an increase in renewable energy consumption leads to a reduction in greenhouse gas emissions*. In the analysis this variable is called: *Renewable Energy Consumption*.

The second control variable is an indicator of the urban population. It is collected from the World Development Indicators database. It measures a country's urban population as a percentage of total population and will be considered as a control for countries' demographic composition (World Bank, 2015a). Studies find that countries with a high percentage of urban population, often seen as an indirect effect of industrialization, leads to a worsening of the environment (Cho & Tobin, 2011). I therefore argued that the urbanization variable is a better indicator than population growth when it comes to controlling effects of the independent variables on emission data. Thus, *I expect that an increase in urban population leads to increased greenhouse gas emissions*. In the analysis this variable is named: *Urbanization*.

The third control variable in the analysis considers economic growth, it is collected from the World Development Indicators database and measures annual GDP growth in percent (World Bank, 2015b). The reasoning behind this choice is simply to control for the economic dimension, in this case different rates of economic growth. *I expect that economic growth will lead to higher energy consumption, thus leading to higher greenhouse gas emissions*. In the analysis this variable is called: *Economic Growth.*

The last control variable is an indicator of industrialization. It measures manufacturing[23], value added, as percent of GDP. The data is collected from the World Development Indicators database (World Bank, 2015c). *I expect that more industrial production (e.g. cement and paper production or other process-industry that are energy intensive) leads to higher greenhouse gas emissions*. In the analysis, this variable is called: *Manufacturing.*

Table 2 presents a detailed explanation of the variables in the TSCS model and table 3 presents descriptive statistics for the variables in the TSCS model.

[23] Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 (World Bank, 2015c).

Table 2: Detailed explanation of the variables in the TSCS model

Variable	Measurement	Unit
Greenhouse gas emission	Man-made greenhouse gas emission	CO_2 equivalent[24]
Environmental tax	Tax revenue from environmental taxes, % of total tax revenue	%
R&D expenditure	R&D expenditure on environmental protection, % of total R&D public budget	%
Technology diffusion	Technology diffusion, % of environmental technology patents of total patents submitted	%
Renewable energy consumption	Renewable energy consumption, % of total energy consumption	%
Urbanization	Urban population, % of total	%
Economic growth	GDP growth (annual %)	%
Manufacturing	Manufacturing, value added (% of GDP)	%

Table 3: Descriptive statistics of the variables in the TSCS model

Variable	N	Mean	Std. dev.	Min	Max
Environmental tax	732	5.813	3.672	-7.507	22.126
R&D expenditure	736	2.130	1.967	0	17.658
Technology diffusion	716	7.611	3.334	1.711	33.333
Renewable energy consumption	736	15.029	15.724	0.442	78.140
Urbanization	736	74.764	10.960	47.915	97.732
Economic growth	717	2.521	3.112	-14.737	11.735
Manufacturing	643	18.076	4.958	5.254	31.367

[24] Thousand tonne

3.5 Time-series cross-section method

According to Beck (2008) "Time-series cross-section (TSCS) data consist of comparable time series data observed on a variety of units. The paradigmatic applications are to the study of comparative political economy, where the units are countries (often the advanced industrial democracies) and where for each country we observe annual data on a variety of political and economic variables" (Beck, 2008, p.1). Whereas panel data often consist of a large number of observations (N), usually survey respondents observed over some years (T) (often called interview waves)[25], TSCS data often have the opposite structure, with relatively small number of observations and longer time periods. Both types of data are structured hierarchically. We ought to think about panel data and TSCS data as multilevel data, but with additional structure. TSCS data have the same problems as panel data, namely heteroskedasticity and autocorrelation (both temporal and spatial). However, I argue that the advantages of TSCS analysis outweigh these potential problems and that there are sufficient solutions to deal with these problems accordingly. As TSCS data combines country and time data, the number of observation increases and this reduces some of the uncertainty that is usually associated with small N studies. Another advantage is that TSCS analysis makes it possible for the researcher to model time and space, and this increases the ability to show causation (Jakobsen, 2013).

Since we are dealing with time series, we could encounter the problem of non-stationarity (often referred to as unit root), in addition to heteroskedasticity and autocorrelation. In order to control for a potential unit root problem, the standard procedure is to use the statistical test called Augmented Dickey-Fuller test for non-stationarity (ADF), with the null-hypothesis that the variable contains a unit root (Dickey & Fuller, 1979). If the unit root problem is present and severe, the usual remedy is to include a lagged dependent variable, using correlograms to guide lag selection (Jakobsen, 2015a).

TSCS analysis also entails that we should control for unit specific effects. The generalized Hausman specification test is the standard statistical test researchers use to check whether unit specific effects[26] are correlated with one or more independent variables in the model

[25] often called *Large N, Small T studies*
[26] i.e. if their error terms correlate.

(Hausman, 1978). This test runs a more consistent model (fixed effects) against a more efficient model (random effects) in order to investigate if the efficient model also gives consistent results (Jakobsen, 2015b). Thus, the Hausman test allows the researcher to choose the appropriate estimator for the model, while accounting for unit effects.

To investigate the effects of variables that in this case represents a quantification of various policy approaches, it makes sense to choose a model estimator that can provide the best information on what happens to the dependent variable when there are changes in values on the independent variables. The fixed effects model[27], often referred to as the within-estimator, is arguably the preferred model for this purpose (Petersen, 2004). By choosing a fixed effects model we can deal with the spatial autocorrelation, as Beck (2008) explains; the fixed effects model is equivalent to unit centering all observation, so that the only question at issue is whether temporal variation in x is associated with temporal variation in y; all cross-sectional effects are eliminated by the unit centering" (Beck, 2008, p. 8). However, the drawback of the fixed effects model is that it makes it impossible to test or control for any variables that are time-invariant, e.g. country size, sea-border or proportion of land area covered in forest.

Equation 1: The general fixed effects model equation

$$Y_{it} = \beta_0 + \beta_{(1,2,\ldots,n)it} X_{(1,2,\ldots,n)it} + (\alpha_i + \varepsilon_{it})$$

Where α denote some unmeasured variable that correlates with one or more of our explanatory variables. α_i together with ε_{it} (the within variance) constitutes the error term (the unexplained variance) in the model. With repeated observations for each unit (e.g. OECD countries over a time-period), we can include unit specific dummy variables and thereafter looking at changes from the mean in each unit. One could manually include unit specific dummy variables for all but one unit in the model. However, it is possible to bypass the manual process by specifying fixed effects in statistical program packages and get output equivalent to the unit centering all observation (Petersen, 2004; Jakobsen, 2015b).

Finally, in order to ensure valid statistical inference when some underlying regression assumptions are violated, as in the case of times-series cross-section analysis; namely

[27] The fixed effects model is also known as least-square dummy variable model or LSDV.

heteroskedasticity and autocorrelation, it is common to rely on some form of robust standard errors. The most popular are the Huber/White robust standard errors, and with cross-sectional dependency as is the case in this analysis, one uses a cluster option of the Huber/White, called clustered sandwich estimator to obtain a robust variance estimate that adjusts for within-cluster correlation (Hoechle, 2007; Williams, 2000).

3.6 Critique and defense of fixed effects model with lagged dependent variable

According to Achen (2000), inclusion of a lagged dependent variable can suppress the explanatory power of the other independent variables in the model, by making some explanatory variables implausibly small and even take on the wrong sign (Achen, 2000). In defense of inclusion of lagged dependent variables, Beck & Katz (2004) investigates how well fixed effect models with lagged dependent variables perform, using Monte Carlo (MC) simulations[28]. Their results show that fixed effect models with lagged dependent variable (LDV) preform as well as other more complicated panel data estimators[29] when running simulations, stating “that there is nothing pernicious in using a lagged dependent variable, and all dynamic models either implicitly or explicitly have such a variable” (Beck & Katz, 2004, p. 1). Judson and Owen (1999) allude to the same conclusion running similar MC simulations for panel data.

Adolph, Butler & Wilson (2005) build on Beck & Katz’s (2004) paper in order to further test the effect of various model estimators using MC simulations, pointing out that fixed effect models or LSDV (least-square dummy variables) have been known to be biased. However, their findings seem to be consistent with Beck & Katz (2004) and Judson & Owens (1999) findings, that fixed effects models with lagged dependent variable generate relatively unbiased results. They argue that political scientists are usually more interested in estimates of the effect of exogenous independent variables (e.g., the unique effects of different policy approaches), and are not that concerned about a lagged endogenous variable (e.g., greenhouse gas emissions that is also determined by many factors outside the model). To summarize the

[28] One definition is that: Monte Carlo simulation are used to model the probability of different outcomes in a process that cannot easily be predicted due to the intervention of random variables (Investopedia, 2016).
[29] the fixed effect model with LDV preforms as well as the more complicated Kiviet estimator, and better than the Anderson- Hsiao estimator (Beck & Katz, 2004).

results of these MC simulations "one interpretation is that so long as the researcher accounts for the unit effects, a variety of estimators give relatively unbiased results (provided, of course, N and especially T are sufficiently large)" (Adolph, Butler & Wilson, 2005 p. 6). An important note is that Beck & Katz (2004) also argue that fixed effects model with LDV outperforms other estimators on efficiency grounds.

3.7 The TSCS model specifications

As the discussion of methodology above implies, that while no single method can guarantee to eliminate all problems associated with TSCS and panel data in general, it is possible to avoid many of these problems by choosing a fixed effects model. In addition, as effects of changes in independent variables over time are of special interest (e.g. have increased environmental taxes resulted in less GHG emission), it makes sense to choose the model that gives the most efficient estimate of whether temporal variation in independent variables in the model are associated with temporal variation in the dependent variable. The choice is further supported by running the generalized Hausman test, that show that a fixed effects model should be chosen over the random effects model[30]. It is also important to remember that since the units are fixed and not sampled, we have to assume that any inference is conditional on the observed units (Beck, 2001), meaning only the 32 OECD countries that are included in the analysis.

To control for unit root in the dataset, ADF testing shows presence of a unit root in 28 of 32 countries and thus imply inclusion of a lagged dependent variable. Running a series of correlograms shows that one-year lag fits the data best. Furthermore, it makes sense to lag the explanatory variables with one year, on the simple basis of causality, X should come before Y in time. On these grounds, the TSCS model is a fixed effects model with lagged dependent variable.

Equation 2: The TSCS model equation:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_{(2,\ldots.,n)} X_{(1,2,\ldots,n)it} + \varepsilon_{it}$$

[30] Hausman test results: chi2(12) = 151.54 – Prob>Chi2 = 0.0000

As previous research implies, a prerequisite for innovation and development is R&D commitment, so in order to test this hypothesis an interaction variable is constructed by multiplying *R&D expenditure* and *Technology Diffusion*, that in the analysis is called: *R&D Tech Diffusion*. Another interaction variable is created to test if there is any evidence that increased taxes have led to more diffusion. This variable is constructed by multiplying *Environmental Taxes* and *Technology Diffusion*. In the analysis it will be called: *Tax Tech Diffusion*.

Finally, in order to control for the missing values on environmental taxes and R&D expenditure, I have constructed two dummy variables to include these in the model. By coding all missing values to 1 and the rest to 0, I account for these missing values in the model. Then it is possible to analyze the rest-variance of the two independent variables in the model. In the analysis these dummies are called: *Dummy Environmental taxes* and *Dummy R&D expenditure*.

3.8 Norwegian case study

The weakness of statistical analysis is the lack of in-depth knowledge about any given case in the analysis. Its main purpose is to investigate broad empirical trends and to that end, it tells us nothing about why or under which circumstances any given policy might work. Thus, selecting a specific case to study in order to complement to the broader quantitative study of policy approaches in the OECD has several advantages. Hancké (2009) warns that attempting to generalize on the basis on a single case can lead to inadequate conclusions, and should be avoided. Hence, the purpose of the case study in this project is not to generalize from the case itself, but rather to investigate the empirical findings of the statistical analysis in a critical case specific manner. It provides an opportunity to dwell deeper into mechanisms that might govern policy outcomes, as well as more explicit support or discouragement for the inference drawn from the statistical analysis, thereby provide the analysis with more robust insight.

While many within the positivistic tradition would argue that little good can come out of testing theory and hypotheses on a single case, there is a growing appreciation among the traditional positivists that case studies can generate useful knowledge, this is especially apparent in the social sciences. And case studies have worked particularly well when combined with statistical or comparative approaches (Moses & Knutsen, 2012). Many recognize the fruitfulness in combining methodological strengths while addressing method-specific weaknesses. As pointed out by Fearon & Laitin (2008), "multimethod research combines the strengths of Large-N designs for identifying empirical regularities and patterns, and the strength of case studies for revealing the causal mechanism that give rise to political outcomes of interest" (Moses & Knutsen, 2012 p. 134, cited by Fearon & Laitin, 2008 p. 758).

Selecting cases to gain more in-depth knowledge can often be very valuable, but it can also imply investigator bias. Many scientists would strongly disprove of selection cases on the dependent variable in order to draw solid inference (Moses & Knutsen, 2012). Thus, the reasons to select Norway as the country to study originates from several other reasons than on the dependent variable, with the most obvious reason for this project – access to data. Getting hold of quality interview respondents and general data collection within the timeframe of the project, as well as traveling expenses are among the reasons for choosing Norway. In addition to these restrictions, Norway also represent a case were the belief in market-based solutions have been at the core of the country's climate policy for a long time. The fascinating feature of Norwegian climate policy is that Norway actually have a CO_2 tax, and have had so for over 25 years. Currently in 2016, the CO_2 tax rate is at 1.02 Norwegian kroner (NOK) per standard cubic meter of gas or liters of oil or condensate. For natural gas burned this corresponds to 436 NOK per tonne CO_2 (Norsk petroleum, 2016; Ministry of Finance, 2016). In 2014, Norwegian prime minister Erna Solberg appointed a commission to "evaluated whether and how a green tax reform can be used to secure reduced greenhouse gas emissions, improved environmental conditions and sound economic growth" (Ministry of Finance, 2015). The commission's main recommendations were to subject all emissions (including non-EU ETS sectors) to the same CO_2-tax per tonne of CO_2e, with a new general rate of 420 NOK in 2016. The increased revenue should be used to reduce taxes for individuals and enterprises (NOU 2015: 15).

On this basis, Norway can be looked at as a critical case. The official Norwegian rhetoric on climate policy is that the Norwegian CO_2-tax is working, a belief held by many main actors, including the Norwegian Ministry of Finance and the majority state-owned oil and gas company Statoil. In other words, Norway makes a good case to study as some of the proposed conditions for MBIs have been in place for a long time and at least rhetorically, the

Norwegian government is actively pursuing and have faith in the results these policies proposedly produce. In other words; if environmental taxes reduce greenhouse gas emission, it should be expected that they have done so in Norway.

To generate case data, I have conducted four semi-constructed expert-interviews with Norwegian respondents, lasting about one hour each, that have provided me with valuable insight. My respondents represent a selection of experts and actors that work or study in the fields of energy, economics and environment policy or technology. The list of respondents and interview guide can be found in Appendix A. As a supplement to the Norwegian qualitative analysis, I have also run a statistical analysis of Norway using the same framework as the OECD, to see if the results are similar or different in Norway. However, as the time series only runs for 23 years, I will only use the regression results with extreme caution.

3.9 The Norwegian regression model and time-series methodology

Longitudinal data registration on variables over time on a single observed unit, like a country, is often referred to as a time series. The strength of this type of analysis is that one can observe changes over time. However, consecutive data registrations on the same variable over time, can lead to data dependency. Any such dependency in the data need to be addressed properly (Christophersen, 2013). Dealing with time series we have to test the data for two factors that can violate OLS regression assumptions, namely; trends and autocorrelation. Trends in time series are often called "random walks" because the general trend is going in one direction, even if specific observations deviates from the trend. In order to investigate trends, the observed time period should preferably be at least 30 years. A time series with a trend are called non-stationary, and time series without are called stationary. A stationary time series fluctuates evenly around a specific value (Christophersen, 2013). The second potential problem with time series data is autocorrelation. If values on a variable in one year is heavily correlated with the value of the variable in the previous year, we say that the time series is autocorrelated, i.e. correlated with a delayed version of itself. The usual procedure to remove trends and autocorrelation is to include one-year lag, creating first order lagged time series. It is also possible to include more than one-year lag, but for short time series this is problematic. To investigate how lag inclusion affects model autocorrelation, it is standard procedure to use the Durbin-Watson d-test to get an indication as whether autocorrelation is a problem in the time-series, and consequently if lag inclusion reduces or worsens the autocorrelation (Christophersen, 2013).

The time series used for Norway has 23 observations, from 1990-2012. This means that the observed time period is under 30 years, and trends can be harder to track. To investigate trends in the time series, it is usual to construct a simple time line plot. From Figure 9 we can detect a slight upward trend in the data, as one would expect since the Norwegian emission have risen a lot during the 1990s.

Figure 9: Timeline trend Norway: Greenhouse gas emission

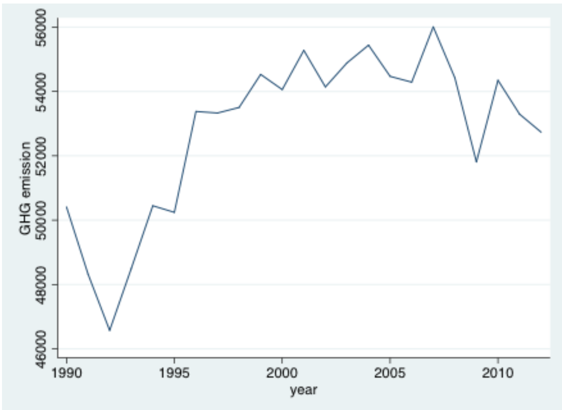
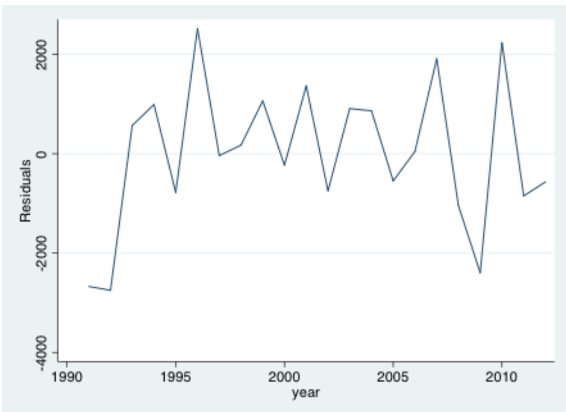


Figure 10: Timeline trend Norway one-year lag: Greenhouse gas emission



After detecting trends in the time series, the next step is to check if the inclusion of a lagged dependent variable will remove the trend. In the case of the Norwegian time series a one-year lagged GHG emission variable made the trend less apparent, as seen in figure 10. Using Durbin-Watson d-test to investigate autocorrelation, with test scores of closer to 0 equals strong autocorrelation and closer to 2 equals no autocorrelation. The test shows that indeed, heavy autocorrelation in the data is apparent: (1, 23 = 0.3591386). Running a complete model with a lagged GHG emission variable, gave the following test results: (2, 23 = 2.032576) thus, no autocorrelation detected. However, running a non-lagged time series model with all independent variables gave Durbin-Watson d-test results of: (8 ,23) = 1.824293, thus leading me to argue that autocorrelation in the model should be of minimal concern, and that the added complexity of an autoregressive model is not necessary.

Table 4 and 5 present descriptive statistics for variables in the Norwegian time-series regression model.

Table 4: Detailed descriptive statistics for the Norwegian dependent variable

Variable	N	Mean	Std. dev.	Min	Max	Skewness	Kurtosis
Greenhouse gas emission	23	52799.740	2537.470	46573.390	56006.290	- 1.006	2.990

Table 5: Descriptive statistics for Norwegian time-series model

Variable	N	Mean	Std. dev.	Min	Max
Environmental tax	23	5.705	2.870	0	8.830
R&D expenditure	23	2.690	0.500	1.800	3.580
Technology diffusion	23	7.360	2.050	4.995	12.260
Renewable energy consumption	23	58.705	1.600	56.260	61.380
Urbanization	23	76.100	2.490	71.955	79.665
Economic growth	23	2.530	1.650	-1.620	5.280
Manufacturing	23	10.200	1.550	7.380	12.450

3.10 Regression results

Equation 3: The TSCS model with fixed effects estimator and lagged dependent variable equation:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 X_{1it-1} + \beta_3 X_{2it-1} + \beta_4 X_{3it-1} + \beta_5 X_{4it-1} + \beta_6 X_{5it-1} + \beta_7 X_{6it-1} + \beta_8 X_{7it-1} + \beta_9 I_{1it} + \beta_{10} I_{2it} + \beta_{11} D_{1it} + \beta_{12} D_{2it} + \varepsilon_{it}$$

where I constitute the interaction variables and D constitute the dummy variables in the model.

Table 6 represents the results of the regression model. The first thing we notice is that the lagged dependent's coefficient is very large, compared to the other coefficients and significant, as we should expect when its heavily correlated with Y. The lagged dependent variable is there mainly for control of the unit-root problem, so interpretation of the coefficient would not yield any substantive information. However, it seems logical to think that last year's GHG emission data would to a degree explain next year's GHG emission, so having controlled for this effect, we can focus on other explanatory factors in the analysis.

In the model *Environmental taxes* show a positive relationship with greenhouse gas emissions. However, this relationship is not statistically significant using a 0.05 acceptance level with a probability value (p-value) of 0.686. Given the high p-value, the sign in front of the variable is also close to being arbitrary due to the high uncertainty. Next in the model we can see that *R&D expenditure* exhibits a negative relationship with GHG emissions at the 0.01 level, that is to say: the model estimates that increases in R&D expenditure leads to a decrease in GHG emissions. The same is true of *Technology Diffusion* it shows a significant negative relationship with GHG emissions, also at the 0.01 level. Thus, the model estimate than an increase in technology diffusion leads to reduced emissions.

The first control variable, *Renewable energy consumption*, display a negative significant relationship with GHG emission at the 0.01 level. The rest of the control variables, that is; *Urbanization, Economic growth* and *Manufacturing* show no significant relationship with the dependent variable. The first interaction variable *R&D Tech diffusion* has a positive sign and has a p-value of 0.06, this is very close to the normal acceptance level of 0.05. Because significant statistical interactions terms are very difficult to uncover, I am inclined to argue that this finding is of significance, and consequently draw any conclusions with caution. Since the interaction variable has a positive sign, it shows that an increase in R&D expenditure leads to an increase in technology diffusion. As both of these original variables exhibits negative relationships with greenhouse gas emission, we can interpret this interaction as an amplifying effect. The second interaction variable in the model *Tax Tech diffusion* is not significant. Lastly in the model we can see that the two dummy variables; *Dummy Environmental tax* and *Dummy R&D expenditure* are neither significant in the model, however these are made to account for missing values of the original variables.

All three unstandardized coefficients of the main independent variables are small in comparison with the effect of the lagged dependent variable, this is obviously linked to the large effect of the lagged dependent variable, as mentioned because this year's GHG emission data is heavily dependent on last years' measurement. Another way to explain this, is that we first control for the unit-root in the dataset using a one year lagged GHG emission variable, hence we account for the variance that can be attributed to last years' measurement. This allows us to study what could explain the rest-variance of the dependent variable by looking at the estimated effects of the independent variables on GHG emissions. Since the dependent variable is log transformed, it is also possible to interpret coefficients as relative change on the dependent variable, that is, in percent. However, the fact that the lagged dependent variable makes the coefficients of the independent variables very small, makes such an effort problematic. It is of course possible to calculate the change in percent, but these results might not yield any substantial information. That being said, the strength of the model is arguably that it gives us an indication of whether these different policy approaches actually have reduced greenhouse gas emissions in the OECD. With a fixed effects model, we would normally look at the estimated within-R^2 to see how much of the variance in the dependent variable our model can explain. However, with a lagged dependent variable in the model such a reading will not be fruitful as the lagged variable is heavily correlated it the dependent variable, thus leading to extreme R^2 values.

Table 6: The TSCS model with fixed effects and lagged dependent variable

	β	**Robust S.E**	**t**	**p > t**
Constant	2.1728	0.4168	5.21	0.000
Log GHG emissions (t-1)	0.8234	0.0390	21.20	0.000
Environmental taxes (t-1)	0.0004	0.0010	0.41	0.686
R&D expenditure (t-1)	- 0.0027	0.0010	- 2.76	0.010
Technology diffusion (t-1)	- 0.0027	0.0010	- 2.64	0.013
Renewable energy consumption (t-1)	- 0.0035	0.0010	- 3.25	0.003
Urbanization (t-1)	- 0.0004	0.0010	- 0.36	0.723
Economic growth (t-1)	- 0.0012	0.0009	- 1.38	0.177
Manufacturing (t-1)	- 0.0024	0.0017	1.43	0.164
R&D Tech diffusion	0.0005	0.0003	1.90	0.066
Tax Tech diffusion	- 0.0001	0.0014	- 0.42	0.675
Dummy Environmental tax	- 0.0184	0.0106	- 1.73	0.093
Dummy R&D expenditure	- 0.0089	0.0084	- 1.06	0.297
Number of observations:	598			
Number of countries:	32			
Time period:	1990-2012			
F-test (12/31):	375.31			
Probability > F	0.000			
R^2:				
Within:	0.8203			
Between:	0.9982			
Overall:	0.9973			
Sigma_u	0.2508			
Sigma_e	0.0392			
rho	0.9762			

Note: (t-1) = one-year lag

4 Case study of Norway

To supplement the broader statistical analysis, I have decided to look closer at Norway to study its policies aiming at reducing greenhouse gas emission. The case study of Norway thus serves two main purposes; to gain deeper insight about the political reality and mechanisms that can affect climate policy decisions and secondly, to evaluate if market-based instruments have worked in a country where they truly are at the core of the climate policy and have been so for over 20 years. To investigate Norway, a brief summary of the country's climate policy history follows.

4.1 Norwegian climate policy, a historic perspective

Fears of rising energy prices after the oil crisis in 1973, in addition to an increased awareness of the environmental impact of fossil fuels, led for the first time Norwegian authorities in 1978 to initiate policy that supported new forms of renewable energy (NRE[31]). By today's standards the initiative was minuscule, as it supported a few projects that worked with wave power and the establishment of a R&D program that included a broader range of NREs. In 1982 it became the first white paper on renewable energy submitted to the Norwegian parliament. *About renewable energy sources in Norway* presented a number of estimates on the current and future role of renewable energy sources. Estimates showed that biomass, wave and wind power could produce around 70 TWh in 2020, compared with the hydropower generation of 90 TWh in 1982 (in 2014, hydropower produced 131.4 TWh of electricity) (NVE, 2015; St.meld. nr. 64., 1981). According to Christiansen (2002), these estimates were restrictive and presented as dependent on the successful outcome of several R&D programs, technological innovations and future rates of market adoption.

Despite the optimistic tone for the long-term outlook for Norwegian renewable energy, the following period after 1982 was marked by substantial cuts in public support for renewable energy development, lasting until 1989. The White paper *Norway's future energy use and production* from 1984, concluded that NRE technology doubtfully could be competitive in the short-term, but emphasized that most of these technologies were at early stages of

[31] Using the concept of NRE from Christiansen (2002), to denote all renewable sources and technologies except large-scale hydro and conventional biomass combustion, such as wind, passive and active solar heat, small-scale hydro, wave and tidal, geothermal, and photovoltaic.

development, thus the priorities should mainly be on R&D. Because of tight budget restrictions the white paper also proposed to keep public support at current level (St.meld. nr. 71., 1984).

In the late 80s climate and environmental policy discourse moved from being a local and regional problem to be a global problem. This shift led climate change issues to the global political stage. Thus, in the following decade several white papers were submitted on the issue of Norway's role in international climate policy. The ambition of the Norwegian authorities was to be a pusher for an international climate regime, with objectives for Norway to reduce its growth in CO_2 emissions in order to stabilize them during the 90s and latest by year 2000 (Christiansen, 2002). The link between climate change and NRE commitment was recognized and studied in the White Paper *Energy-economising and energy research* in 1989. The report studied public support for NRE technologies and the continuation of governmental R&D programs. The White Paper also raised concern about the lack of a good institutional framework for coordination of public support for NRE technologies. Thus, it was proposed to establish goal-oriented and time-limited R & D programs of each NRE technology (St.meld. nr. 61., 1988; Christiansen, 2002). During the 90s, on the renewable support policy side the Norwegian authorities started to focus on international cooperation and coordination of research to avoid duplication of activities.

While the focus on NRE usually ended with support for continuous R&D commitment, for regulation of pollution and environmental protection the use of taxes has been evident. As early as 1971, a tax on sulphur in mineral oil was introduced by the Norwegian government. This approach was continued by tax on petrol, tax on nitrogen and phosphor in mineral fertilizer, and tax on pesticides and lubrication oil in the time period between 1986 and 1998 (Ministry of Finance, 2007). It was the CO_2 tax of 1991 that really marked a shift in the increased use of MBIs in Norwegian climate policy, as the *Act relating to CO_2 tax in the petroleum activity on the continental shelf* passed legislation in the Norwegian Parliament. It has since been revised two times (in 1996 and 2006) and in its current form states that: § 1. Parliament adopts it to to be paid CO_2 tax to the Treasury for the burning of petroleum and natural gas emanations in connection with petroleum activities on the continental shelf, (Lovdata, 2015, translated to English by author)[32] and that § 2. The CO_2 tax is calculated for petroleum that is burned and natural gas being emitted into the air, as well as of CO_2 which is separated from petroleum and discharged to the air, on installations used in connection with production or transportation of petroleum[33].

Going past 1991, as apparent in the White Paper*: About Norwegian policy on climate change and emissions of nitrogen oxides (NO$_x$)* from 1995, the Norwegian climate strategy shifted from domestic GHG emission targets, towards a more cost-effective strategy which aimed to reduce and stabilize global GHG emissions. Fast forward to 1997, where Norway signs the Kyoto Protocol as an Annex I country[34] and submits the White Paper: *Norwegian implementation of the Kyoto Protocol* to Parliament in the spring of 1998. Part of the mechanisms embedded in the Kyoto protocol was added flexibility in ways to reach emission reduction targets. Such as the possibility to buy emission quotas in other countries, and the clean development mechanism (CDM), in which the Annex I parties could invest in emission limiting projects in developing countries. The Norwegian government worked intensively for the inclusion of flexible mechanisms in the Kyoto Protocol, so Norway may take most of the emissions cuts outside the Norwegian borders. Whether this is good or bad may be hard to say, but it is certainly closely linked to a belief in market-based solutions, i.e. letting Norway cut where it is most cost-efficient, rather than at home. Norway have used these mechanisms extensively in order to reach Kyoto emission targets, as a means to allow a petroleum sector in rapid growth. Domestically, the focus now was to consume energy more efficiently, development of NRE technologies and the introduction of a policy package with supply-push and demand-pull strategies.

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[32] In Norwegian in Appendix C

a) in internal Norwegian waters, the Norwegian territorial waters and on continental shelf, cf. the Petroleum Act § 1-6 letter l),
b) in adjacent waters outside the continental shelf to the extent production of petroleum is reserved Norway by agreement with another state,
c) in waters outside the continental shelf as far as Norwegian facilities for transportation of petroleum,
d) in the kingdom as regards installations covered by the Petroleum Taxation Act § 3 b), third sentence.

When extraction occurs from petroleum deposit that stretches across the midline in relation to another state, cf. letter b), the CO_2 tax is calculated only by the amount corresponding to the Norwegian licensees' stakes in the facility in question.

[34] There are 43 Annex I parties, resembling the first countries to join the protocol (UNFCCC, 2014b).

This was followed up by the White Paper *On Energy Policy* in 1999 where the emphasis was on financial incentives to increase the implementation and development of NRE technologies, incentives such as exemption from investment taxes and electricity taxes for NRE projects. The authorities also pressed for an increasing public support for development and long-term stability for investment subsidizes for NREs (Christiansen 2002). In contrast to Germany and later Spain and Denmark, where feed-in-tariff led the efforts to increase renewable technology, Norway never implemented FITs. And when the European Union implemented the Renewable Energy Directive in 2008, as part of the EEA, Norway became tied to what is known as the EU 20-20-20[35], and yet again opted for a market-based solution. In cooperation with Sweden, the Norwegian government went for a scheme called *Green Certificates* (Forskrift om elsertifikater in Norwegian), which passed legislation in 2012. The scheme forces utility companies to buy these green certificates and in theory, should create demand for more renewable energy in the electricity market (NVE, 2016). It is founded on the principle of technology-neutrality with an overall renewable energy production target of 28.4 TWh by 2020, of which Norway will finance half (Ministry of Petroleum and Energy 2014b).

Currently the Norwegian principle climate policy document is the Agreement on climate policy ("Klimaforliket" in Norwegian), it was adopted by the Stoltenberg II government in 2008 and continued by the Solberg government along with the Liberal Party and the Christian Democrats in 2012. The agreement guidelines now emphasize; increased funding for the Climate-and technology-fund, the prohibition of use of fossil oil in Norwegian households and buildings by 2020, favorable conditions for zero-emission vehicles through favorable tax and tax credits, increased transfers to public transport and increased funding for research centers that work with renewable and environmental friendly-technology (Ministry of Climate and Environment, 2012). Norway has also been a participant in the EU ETS since 2008, and in 2015, 48.7 percent of Norwegian emissions were covered by the emissions trading system (Energi og Klima, 2016). In 2009 the Research Council awarded eight research consortium the title; Centres for Environment-friendly Energy Research (FME) as part of the follow-up to the Climate Agreement in 2008. These FMEs are primarily doing

[35] The Renewable Directive dictates that 20 percent of EU energy to come from renewable energy sources, 20 percent increase in energy efficiency from 1990 levels and 20 percent reduction in greenhouse gas emissions from 1990 levels by 2020 (Ministry of Petroleum and Energy, 2011).

R&D and have received increased funding for their respective R&D programs in the years after 2009. In 2011, three new centers received the status as FME, increasing the total to 11 such centers in Norway today, with 8 new FMEs approved with start-ups in 2017 (Research Council of Norway, 2016).

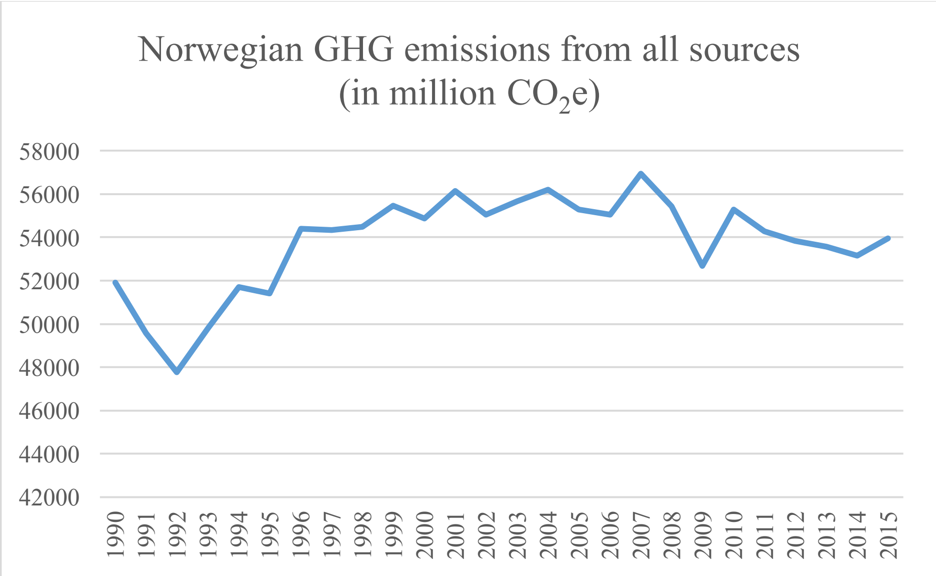
Looking back at the Norwegian climate policy history, there are thus two main trends apparent. The first and most prominently is that Norway consistently has shown a preference for market-based-solutions, in one form or another, i.e. taxes, emissions trading through the EU ETS, flexible mechanisms from the Kyoto protocol and green certificates. And secondly, that the Norwegian government has supported R&D initiatives albeit with various degree of financial backing, and now lately with the expansion of the FMEs increasing the total to 19 such centers in 2017. It all provides an image of a country that is a particularly interesting test-case with respect to whether or not market-based solutions have actually worked up until now.

4.2 Norwegian emissions by the numbers

Looking at Norway's GHG emission history, it has drastically increased its emissions during the 90s into the 2000s largely due to the expansion of the petroleum industry. Compared to 1990 levels, Norway's emissions have actually risen 3.9 percent (2015 numbers). For reference, EU have collectively seen a 23 percent reduction, in the same period (2014 numbers) (Energi og klima, 2016). As most industrialized countries around the world, Norway also saw a significant drop in emissions after the 2008 financial crisis. Norway's GHG emissions record from 1990 to 2015 can be seen in its entirety in Figure 11 in million CO_2e (SSB, 2016a – raw data provided in Appendix E).

According to the preliminary numbers from Statistics Norway (SSB), Norwegian greenhouse gas emissions rose by 1.5 percent in 2015, breaking a long trend of emission reduction. Total Norwegian emissions were 53.994 million tonnes of CO_2e (Lie, 2016; SSBb, 2016b). Flaring at the newly operational Knarr gas-field, increase in agricultural related emissions, an increase in fertilizer production and increase in traffic are among the factors contributed to the emission increase. Regardless of well-known factors, this emission increase has been embarrassing for Norway's résumé as an aggressive climate nation, putting into question if Norway can reach their climate goals (Doyle, 2016).

Figure 11: Norwegian GHG Emissions History 1990-2015.

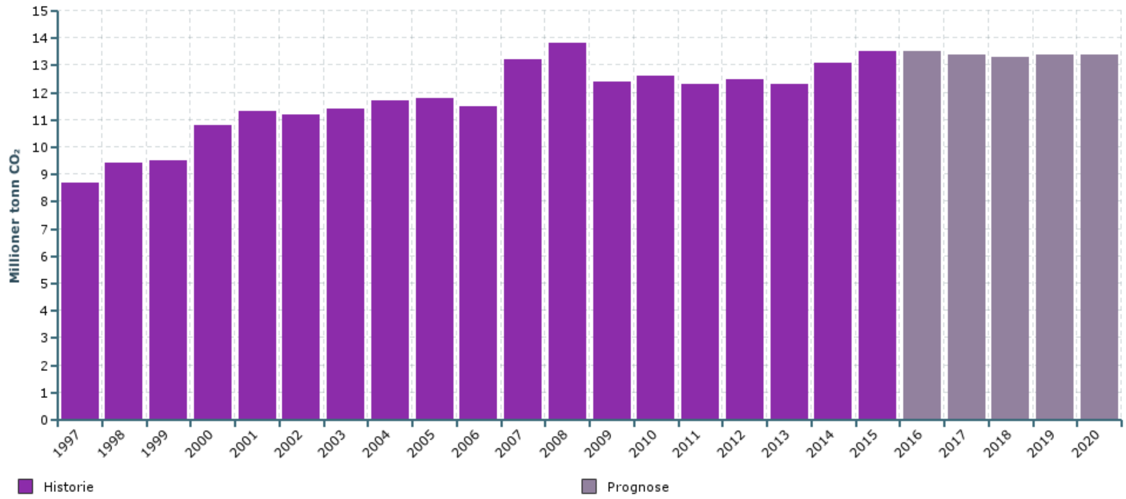


In interviews with Teknisk Ukeblad; both leaders of two of the largest environmental organizations in Norway, Bellona and Zero Emission Organization, were very critical of the news that Norwegian emissions had increased in 2015. Outspoken Bellona leader Fredric Hauge said that “This is the result of a deliberate policy of political decisions. This is serious, and it is the opposite of a green shift”. Hauge warns that Norway is about to become a climate rouge, pointing to the fact that any development of projects in the Barents Sea from the 23rd licensing round will provide even greater emissions than we currently see in the North Sea. Zero leader Marius Holm replied that “While we are discussing 2030-goals, our emissions are rising. We understand that many measures will first have an effect long-term, but we must also take measures that have an effect right now” (Lie, 2016, translated to English by author).

Norway’s ministers of Climate and Environment Vidar Helgesen, responded to the bad news in an official press release on may 20th, 2016. “Last year’s numbers for greenhouse gas emission are sadly not surprising. A large part of the increase comes from oil- and gas extraction, especially emission from fields that were opened in the past decade. These figures are in line with projections the Environment Agency has made for the period up to 2020. They show that petroleum emissions will reach its peak just before 2020, then decline”

(Ministry of Climate and Environment, 2016, translated to English by author). The statement can be compared with projected emission from the petroleum industry itself. As the petroleum sector makes up 28 percent of total emissions, it remains Norway's main emissions contributor (Lie, 2016). According to historical and projected CO_2 emission[36] from the sector we see in figure 12 (Norsk Petroleum, 2016), CO_2 emission should already have peaked in 2008 (post financial crisis) and after seeing an increase to 2016, is then projected to stay relatively flat on these levels until 2020 (Norsk Petroleum, 2016).

Figure 12: Historic and Projected CO2 Emissions from the Norwegian Petroleum Sector 1997-2020



4.3 The Norwegian CO_2 tax

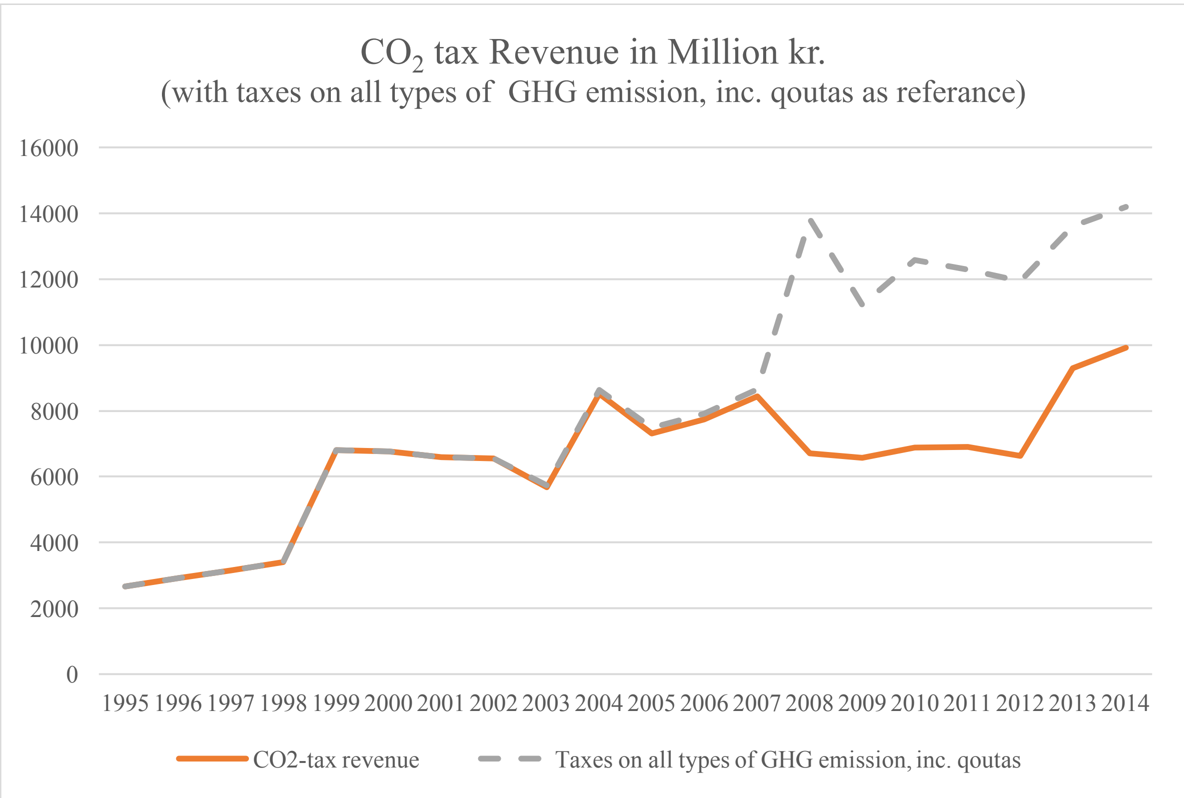
Minister Helgesens press release also points out that it is the Norwegian administration's view that, even though emissions are up, it is not the same as that Norwegian climate policy have failed. On the contrary, that Norwegian climate policy is quite ambitious. The minister cites numbers that can be found in the 2016 revised national budget. The report, presented to the Norwegian Parliament on May 11th 2016, states that the Norwegian climate policy substantially reduces national emissions, and that the measures introduced since 1990, have reduced national GHG emission by 13-15 million tonnes of CO_2e in 2010 and 17-20 million tonnes by 2020, compared to scenarios without these measures. Of these measures the

[36] Of the 14.2 million tonnes of CO_2e emitted from the petroleum industry in 2015, 13.5 was CO_2, and the rest CH_4 (methane), thus analyzing CO_2 covers most of the emission (Norsk Petroleum, 2016).

Norwegian CO_2 tax is attributed much of the emission reduction, as stated in the report; "the CO_2 tax is the instrument that has contributed to the greatest emissions reduction since 1990. Emissions per unit produced has dropped sharply, and Norway are among the OECD countries with the lowest emissions per unit of GDP" (Ministry of Finance, 2016a p. 50, translated to English by author) Nevertheless, 15 million tonnes over 20 years only accounts for about 1.5 percent annually.

Currently in 2016, the CO_2 tax rate is at 1.02 Norwegian kroner (NOK) per standard cubic meter of gas or liters of oil or condensate. For natural gas burned this corresponds to 436 NOK per tonne CO_2e (Norsk petroleum, 2016; Ministry of Finance, 2016b). As shown in figure 13 (SSBc, 2016 – raw data provided in Appendix E), the Norwegian State generated approximately 9.9 billion NOK in revenues from the CO_2 tax in 2014 and around 14.2 billion NOK from overall taxes and quotas.

Figure 13: Tax Revenue from Norwegian Environmental Taxes 1995-2014



The green tax Commission appointed by the Erna Solberg's administration to evaluate new ways to use green taxes for environmental goals is another reminder of the dominant view in Norwegian climate policy. The Commission delivered its recommendations in NOU 2015: 15 Environmental pricing – Report from a Green Tax Commission, in December 2015. Two of the main recommendations of the Commission are to subject all emissions from non-EU ETS sectors to the same CO_2 tax per tonne of CO_2e, and set a new general tax at the same level as the current CO_2 tax level on petrol and diesel (420 NOK in 2016). And finally it is the Commission's recommendation that emissions currently covered by the EU ETS should in principle not be subjected to the CO_2 tax. However, it proposes to retain the tax on petroleum and aviation activities that are currently subject to both the EU ETS and the Norwegian CO_2 tax. The increased revenue from these recommendations should be allocated to general tax rate reductions for individuals and enterprises (NOU 2015: 15). The report also states that:

> "A successful environmental policy cannot be based exclusively on environmental taxes, but the Commission believes that it should be feasible to use environmental taxes to a greater extent than at present. In comparison with alternative policy tools, taxes have attractive characteristics, such as cost effectiveness (the most environment per Norwegian krone spent) and the generation of tax revenues" (NOU 2015: 15 p. 11).

Thus, it acknowledges that policy cannot solely be based on green taxes but nevertheless wants to increase the use of them, citing the theoretical attractive attributes of MBIs. The Zero Emission Organization has been skeptical of the Commission's recommendation. Zero leader Marius Holm says in a press release that: "the purpose of green taxes is to adapt ourselves to zero-emission society, not to continue the fossil society at the lowest possible tax level" (Sbertoli, 2015, translated to English by author).

It seems quite clear that the official Norwegian view is that market-based solutions work, and that they provide the most efficient way to reduce emissions.

4.4 Statoil

Perhaps the most important single actor both domestically and internationally when it comes to affecting emissions is the state majority-owned oil and gas company Statoil. As any company operating on the Norwegian continental shelf (NCS), Statoil is subjected to the current principal legislation that regulate subsea petroleum activities[37]. Thus, any oil and gas exploration and operations on the NCS is pending approval from the Norwegian State. An important note is that although the Norwegian State is the majority owner of Statoil, it does not get preferential treatment when it comes to licenses or other regulatory enforcements from the Norwegian State (Statoil, 2011).

Statoil's official view on sustainability and climate change is that there is overwhelming evidence of human-induced climate change. Statoil acknowledges that it is a global problem and wants to be part of the solution. The view is that the world is still largely dependent on oil and gas, and while renewable alternatives are growing, oil and gas will still have a key role for many decades to come. Statoil is supporting efforts to establish global carbon pricing; "Still it is our belief that a global carbon price would be the most cost-efficient way to reduce emissions and therefore we believe that governments and companies should continue to work together to ensure that a carbon price is applied throughout the global economy" (Statoil, 2015b), but acknowledges that this will not happen overnight and therefore sees national or regional carbon pricing schemes as the most likely in the short-term. On how they actively supporting carbon pricing, Statoil answer that they are actively calling for a 40 percent greenhouse gas target in the EU and a significant strengthening of the EU ETS, and working internationally to contribute to well-designed carbon pricing schemes in China and other countries. Statoil also includes a cost of $50 per tonne CO_2e when evaluating new projects outside Norway (Statoil, 2015b).

Before the UNFCCC COP21 in Paris, six oil and gas executives, including Statoil signed a joint letter to the summit, announcing their call for governments to introduce carbon pricing in order to fight climate change. The letter states as follows:

> "Our industry faces a challenge: we need to meet greater energy demand with less CO2. We are ready to meet that challenge and we are prepared to play our part. We firmly believe that carbon pricing will discourage high carbon options and reduce uncertainty that will help stimulate investments in the right low-carbon technologies

[37] The Norwegian Petroleum Act of 1996, and the Norwegian Petroleum Taxation act of 1975, together constitute the following two main principles; "the Norwegian State is the owner of all subsea petroleum on the NCS, that exclusive right to resource management is vested in the Norwegian State and that the Norwegian State alone is authorized to award licenses for petroleum activities" (Statoil, 2011).

and the right resources at the right pace. We now need governments around the world to provide us with this framework and we believe our presence at the table will be helpful in designing an approach that will be both practical and deliverable.” (Helge Lund, BG Group Plc; Bob Dudley, BP plc; Claudio Descalzi, Eni S.p.A.; Ben van Beurden, Royal Dutch Shell plc; Eldar Sætre, Statoil ASA; Patrick Pouyanné, Total S.A.) (Statoil, 2015c).

4.5 The Norwegian regression model

To supplement the qualitative case study, I have constructed a simple time-series model of Norway using the same variables as the OECD analysis. Table 7 present the results from the Norwegian regression model.

Table 7: Time-series regression model of Norway 1990-2012

	β	**Robust S.E**	**t**	**p > t**
Constant	5167.005	74826.230	0.07	0.946
Environmental taxes	577.667	1349.333	0.43	0.675
R&D expenditure	- 2208.953	1018.976	- 2.17	0.047
Technology diffusion	- 557.766	243.192	- 2.29	0.037
Urbanization	703.588	836.207	0.84	0.413
Economic growth	- 308.769	305.096	- 1.01	0.328
Manufacturing	119.100	1005.043	1.12	0.907
Dummy Environmental tax	2673.945	11589.430	0.23	0.821
Number of observations:	23			
Number of countries:	1			
Time period:	1990-2012			
F-test (7/15):	10.01			
Probability > F	0.0001			
Durbin-Watson d-statistics (8, 23):	1.824293			
Adjusted R^2:	0.7415			

As mentioned in the methodology section, a regression analysis consisting of this few observations can only be interpreted with a lot of caution. However, not only are the results very clear, but they also very much correspond with the broader OECD analysis. Thus, as in the broader OECD analysis, the model emphatically shows that environmental taxes have a non-significant relationship with Norwegian GHG emissions, whereas R&D expenditure and Technology diffusion are significant and correlate negatively with GHG emissions. The interaction variable between R&D and technology diffusion was not significant in the Norwegian time-series.

4.6 The Norwegian case

There is little doubt that Norway is an interesting case to study the effects of climate policy approaches, and market based approaches especially. As I alluded to in the introduction of the Norwegian case study, the purpose of the case is to closer investigate the mechanisms which govern policy outcomes and if market-based instruments have worked in a country where they are at the core of national climate policy. To that end, in addition to the empirical study and the regression model of Norway presented above, I have conducted four expert interviews with various actors working or studying this field.

According to several official documents and in the official rhetoric, from the government and several ministries – the Norwegian CO_2 tax has been and is the most important single instrument to reduce domestic GHG emissions. So the official story is that it has worked, the question then becomes, is this story feasible?

Going back to 1991 when the tax was first introduced, it was, according to one respondent very much opposed by the industry, and was partly negotiated in secrecy. Then, as the tax was implemented, sectors and industry went from a state of little regulation to a state where they suddenly had to take into account these extra costs. Thus, there are several indications that the taxes had an immediate effect in an early phase. There was much activity, and the industry took measures that made economic sense within the new tax level. But as soon as the "low hanging fruits" are plucked, the tax system needs to be adjusted accordingly or no further emission reduction will occur. Hence, one of the key indicators of how well a MBI is working could presumably be to measure the activity level in the industry/sector, e.g. their R&D commitment, energy efficiency goals, other implemented emission reduction measures over time. According to several respondents, there is reason to believe that the tax level has not been adjusted adequately over time, the way it should be to achieve cumulative emissions reduction. Several of the respondents agreed that the encouraging activity seen in the early stages after the tax was introduced have likely stagnated.

As pointed out, the massive expansion of the petroleum sector has in large part increased Norwegian emission since the reference year 1990. Although being subject to at least modest tax rates by international standards, it is reasonable that the petroleum industry operating on the NCS can still live quite well with the current CO_2 tax.

So this raises a couple of questions, the first being: Does the current CO_2 tax change behavior? Are there any reliable and credible examples of projects or developments that the CO_2 tax has contributed to, which would not exist without the tax? And the secondly, how are these taxes affected by the political and economic situation? E.g. is it feasible to think that tax rates will become higher in a foreseeable future, as we approach more stringent emission targets? Or is it in fact more likely that they are more vulnerable to cuts rather than increases, when faced with sudden changes in political reality?

According to one respondent, it is unlikely that actors have changed their behavior due to the taxes and other MBIs. Still, some argue that the CCS installation on Sleipner would not have been realized without the CO_2 tax. However, this is very hard to measure, because the question is contra-factual in nature. Another respondent doubted very much that the MBIs had changed any significant behavior because the profit from one tonne of CO_2e far outweighed the cost of the CO_2 tax. And everyone I interviewed agreed that the tax level needed to be much higher to produce significant emission reduction.

Talking to Zero revealed how it is always difficult selling their proposals to industrial and political actors, and that they very consciously considered whether the actors will realistically accept what they propose. Thus, Zero always suggests increasing environmental taxes, but have many other suggestions as well because they know how hard it is to sell these tax increases. It is simply not very politically feasible in the current political environment, and will perhaps be hard to achieve regardless of political constellation. Similarly, when I discussed the recommendation from the green tax Commission with several of the respondents, most agree that it was highly unlikely that the main recommendations would pass into legislation. When faced with political reality, these taxes are very hard to raise. When tax proposals reach political negotiation, they are met with resistance from every level. In the current political environment, it may be even more so, with the Conservatives and the Progress party at the reigns. As a result, tax negotiations are likely to be opposed, regardless of how theoretically pervasive they might be. This is also very much in line with what Patt (2015) found and that I have already written about in the theory section. Another important point raised by one respondent, is that if you have a sudden new political reality, the pressure on the political authority to reduce burdens on the affected industry mounts quickly, and taxes like the CO_2 tax becomes an easy target. This is exactly what happened in 1998, when the petroleum industry hit a rough patch, with the Norwegian CO_2 tax subsequently reduced nearly in half because of the crisis in the petroleum sector.

While there was little optimism to track from the conversation of how MBIs have worked and their prospects for the future, there seems to be some enthusiasm towards Norway's public commitment to R&D. One of the respondents answered that their firm had and were working in collaboration with the public research programs for some R&D programs, as well as projects that were granted support from various Norwegian public support schemes or grants from the Research Council. Several of the other respondents also pointed out that Norway have been fairly generous when it comes to R&D efforts. This claim is further supported by the fact that just recently the government approved 8 new FMEs.

Two of the respondents argued that the Norwegian electric vehicle subsidies have been a success, and that by using the tax system in this way, Norway have created the world's largest EV market. Others argued that the subsidies are wasted money, and the environmental effect very small.

So in order to assess if MBIs have worked in Norway or not, to my mind, it then becomes a question of how you measure environmental goals and how ambitious these goals are made out to be. The official number that is being operated around is that the effect of Norwegian climate policy will contribute to a reduction in domestic emissions by 17-20 million tonne of CO_2e by 2020 from the reference year 1990, compared to a scenario without these measures. Based on the official statements these climate goals are very ambitious, but it is hardly any secret that Norwegian emissions have risen almost 4 percent since 1990. This peculiar fact begs the question of how ambitious these goals really are. One way of looking at it is that Norway can utilize the flexible mechanisms embedded in the Kyoto Protocol in order to reach their climate goals, even though domestic emissions go up. In an interview with Teknisk Ukeblad, Climate and Environmental Minister Helgesen says that "we have to have as a starting point that there will be a significant demand for oil and gas in the foreseeable future. The petroleum sector is part of the EU ETS, and the quota price will be considerably higher in a 15-25 years' perspective" (Lie, 2016). The minister therefore assumes and is counting on that the EU ETS prices will go drastically up.

I have earlier described Norway as a critical case. However, Norway is also a very peculiar case, in the sense that it is one of the world's biggest petroleum exporters. Thus, it is very hard to see the Norwegian discourse on environmental taxes isolated from its dependence on revenues from oil and gas. Here as well, the respondents added to the image provided by the two quantitative analyses. In an attempt to reconcile these conflicting views between economic and environmental goals, the Norwegian energy minister Tord Lien is proposing that "cleaner" Norwegian gas is ready to replace "dirty coal", primarily in the EU, because the world needs (preferably as much Norwegian) oil and gas in many decades to come (Norsk olje & gass, 2016). This rhetoric points at an attempt to legitimize oil and gas exploration in the Barents Sea, through the 23rd licensing round (Ministry of Petroleum and Energy, 2015; Norwegian Petroleum Directorate, 2015). However, according to a KonKraft rapport; estimates for production start for some of these new projects will be around 2030 (KonKraft, 2016 p. 53), where demand for oil and gas can be very different depending on the success of climate policy. This is an approach that can also be seen in the ban that the Norwegian Government pension fund (often referred to simply as the Oil fund) in 2015, and with the backing of a unanimous parliament put on investing in coal companies or companies with over 30 percent of their activity in coal. Since these new guidelines went into effect on February 1. 2016, Norges Bank has decided to divested shares in 52 coal or coal related companies worldwide (Havnes, 2016). While this is by all means good policy from a climate point of view, it is also symptomatic of the overall Norwegian approach: pulling the Norwegian Oil fund out of coal companies does not harm Norwegian interests in the energy market. On the contrary, the divestment strategy in coal actually lines up very well with the expansion of Norwegian gas activities and increased export to Europe, as market shares from coal are at play.

What seems quite clear is that Norway's affection for environmental taxes over other climate policies has to do with the underlying premise that petroleum is, and will continue to be, Norway's most important industry and source of income. Therefore, it is fair to say that Norway's oil and gas interests in most cases overshadow domestic climate policy, a view the respondents agreed on. It is simply hard to decouple Norwegian climate policy from Norwegian oil and gas interests. Norway's official view is that it has a very ambitious climate policy, with 80 percent of domestic emissions subject to either the CO_2 tax or the EU ETS, or both. So the question is: how ambitious is it really? If you count the revenue from oil and gas, are the CO_2 tax and the EU ETS stringent enough to change behavior, or are they these extra costs just negligible for the oil and gas companies? As two of the respondents put it; participating in the EU ETS and having a CO_2 tax does not mean that it's working.

Based on the evidence above, it is hard to conclude that even in the critical case of Norway environmental taxes have had much of an impact. Instead, conforming to the results of the OECD analysis, in Norway as well, R&D and technology diffusion is what has had an actual negative impact on GHG emissions, whereas the environmental tax variable is very much not significant in either analysis. Both the qualitative and the quantitative analysis point quite clearly in the same direction. Granted, the qualitative analysis also points to the fact that the Norwegian government has estimated the size of the GHG emission "savings" as a consequence of the carbon tax. However, first these savings are not particularly impressive (about 1.5 percent annually), and second all the respondents suggested that to if environmental taxes have worked in Norway at all, the impact that they have had has at best been very minor. Instead, they essentially confirmed Patt's (2015) suggestion from the theory section, namely that it is politically very hard to bring environmental taxes up to a level where they actually make a difference.

5 Discussion

5.1 Market-based instruments, have they worked?

The statistical analysis shows that there is no statistically significant relationship between greenhouse gas emissions and environmental taxes in the OECD from 1990 to 2012. Since the theoretical arguments and empirical evidence for environmental taxes were clearly contradictory, I decided to construct two main hypotheses. The result from the regression model implies that I have to reject the hypothesis that: *Environmental taxes have led to a reduction in greenhouse gas emissions,* and thus confirm my other hypothesis that: *Environmental taxes have had little effect on greenhouse gas emissions.* And there are actually several reasons to believe why this result is as expected.

While it might be surprising to some, both the empirical evidence as well as the experts I have interviewed agreed that this seems like a plausible result. Their argument was that it always seems to come back to that it is politically impossible to raise environmental taxes to a level where they actually make much of a difference. Admittedly, it is very easy to be swayed by the theoretical foundation on which market-based instruments are based on, because they lay out a very clear solution and even promises to do so at the lowest possible cost. But no matter how beautiful and persuasive the theoretical argument is, my interpretation of the evidence presented, is that everything points to the fact that when environmental taxes face political reality, it seems apparent that they have in most cases been thrown to the wolfs and ended up either defeated or severely diminished. Several environmental tax proposals, some which I have described in pervious chapters' have met serious opposition in the political negotiation progress and this leads me to think that the the multitude of conflicting political goals and interest that meet these proposals depicts a very plausible explanation of why these taxes have not produced any significant emissions reduction.

There are also some very plausible explanations for the weak performance of environmental taxes that can be found in the studies of how these taxes are seen by the industry. Daugbjerg & Svendsen (2003) argue that taxes are especially difficult to impose because it implies that the tax-receiving sector or industry have to pay both the tax *and* the abatement cost, and according to Cho & Tobin (2010) this increases the chance for evasive maneuvering, outsourcing and increased lobbing from affected industry. One of the experts I interviewed also pointed out that although a sector or industry is likely to accept some forms of regulation like a tax, there is a very thin line between reluctant acceptance and fierce opposition, and with the latter response – one would think that the likelihood of exemptions and unambitious tax rates increases. On the political side, the evidence also points to fears among politicians to impose heavy regulation on their national industry. And although in the end, as one of my respondents pointed out; governmental regulation can be just as helpful as problematic for long term competiveness, because it forces the industry to be more efficient and innovative, these advantages are much more difficult to justify in the short-term. And this might be another reason why, for example in the EU, it was easier to introduce a cap-and-trade scheme than a carbon tax. Although it seems that the EU ETS suffered the same fate as most tax proposals, namely – not at a level needed to make much difference.

If it is too difficult to introduce these taxes and even more difficult to raise existing environmental taxes to rates that actually will change behavior, it then seems reasonable to have the discussion if they are worth all our time and effort. This is essentially Anthony Patts' point as well for why carbon taxes so far have been a dead end and a distraction. If it is so hard to pass meaningful environmental tax- or cap-and-trade policy to the levels really needed to curb emissions, and that it is highly unlikely that that is going to change in the very near future, we should abandon further efforts and rather focus on policy approaches we know to have worked. This also applies to efforts relating to global carbon pricing schemes, pushed forward by powerful financial organizations like the IMF and the World Bank and the official view of several major oil and gas companies, including Statoil. However, such efforts will not be possible without a global institution of sufficient size to minister and regulate a comprehensive global carbon tax or market. And while my analysis cannot predict future outcomes, nor draw any inference of outcomes outside the OECD, we can nevertheless provide some theoretically informed speculation about the extent to which the future will be radically different. Here, Dryzek (2013) and Patt (2015) points to several mechanisms that explain why global institutions might take fifty years or longer to develop. Dryzek explains that there is an underlying inertia in established institutional practices, that is mainly coming from resistance to changing these routines. Patt also adds that the establishment of mutual trust and the codes of conduct would take a very long time to take root. It thus seems like a very unrealistic time frame if we take any climate scenario and climate science in general seriously. Some would point to the EU ETS as an example of how to establish a regional cap-and-trade system within a proper institutional framework, however as most experts, including those I interviewed would say that the EU ETS has at least until now been a failure and unless EU policymakers seriously ramp up stringency measures and get rid of millions of excess quotas, it will not do much to reduce emissions. Thus, while my conclusions can strictly apply only to the past, what we have above is a theoretically plausible argument why environmental taxes might remain impotent as a tool to prevent climate change also for the foreseeable future.

Although it seems like MBIs have a poor empirical record for emissions reduction and are working against some overwhelmingly negative odds, I would deem it highly unlikely that efforts to introduce MBIs like taxes and cap-and-trade schemes will diminish anytime soon. As the issue of climate change and climate policies moves closer to the center of the political stage, it is rather more likely that the climate policy discussion will move even further from the jurisdiction of Ministries of Environment and in to the Ministries of Finance. And as a consequence, an increased focus on selling market-based instrument like taxes as *the solution* to reduce emissions. My suspicion is that there will be a pressure to introduce environmental taxes to the point where compromises will undermine their function. Taxes are after all, attractive because they also generate revenue, and they will generate a significant amount even at modest or even low rates even if their effect on emissions are slim to none. One potential outcome with lower environmental taxes could be to earmark these revenues to fund for example R&D or other environmental protection measures.

Therefore, on the basis of the quantitative as well as the qualitative evidence presented in this project what then seems reasonable, is that market-based instruments like environmental taxes have not be particularly effective at reducing emissions in the OECD. So the question becomes, what has then led to emissions reduction? And why is it plausible that it has?

5.2 How critical will public funded R&D be towards a low-carbon future?

My analysis of the OECD show that governmental R&D expenditure on environmental protection have a significant negative effect on GHG emissions in the OECD at the 0.01 level. Furthermore, there is also reason to believe that R&D expenditure has an amplifying effect on technology diffusion, in other words, that increased public spending on R&D lead to more diffusion. The regression results thus confirm my hypothesis that: *Increased public spending on environmental R&D leads to reduced greenhouse gas emissions.* The analysis only included governmental RD expenditure on environmental protection, therefore I have no real measurement of clean energy R&D. This is an obvious weakness of the statistical model, but as I argued in the methodology chapter, there was no way to separate clean and fossil-energy R&D in the database. Thus I decided to go with the most refined measurement, and test with energy R&D in a control model. This model can be found in Appendix B named model 3., the model turns out to be very similar to the model in the analysis, leading me to think that it is plausible to think that advances in energy technology in general has an aim to increase efficiency, and that in many cases this leads to an overall improvement, like the move from single CGT technology to combined CGT. Although model 3. also seem to be a well specified model, I have still decided to use the variable without Energy R&D to guard against the potential source of error from fossil-energy related R&D expenditure in the data.

The R&D variable was not significant in my first models, and it only became significant after I added the interaction variable with R&D and Technology diffusion. To compare these, I have included the main model, called model 1. and a model without the interaction variables, called model 2. in Appendix B. It implies that the negative effect on emissions we see from R&D expenditure seems to be dependent on technology diffusion. Thus, the casual relationship I described in the theory section, implies that we might expect governmental R&D expenditure to have an indirect effect on emission seems to hold true. Hence, one plausible interpretation is that R&Ds negative effect on emissions depends on the diffusion of successful R&D outcomes.

The result is also in line with Cho and Tobin (2010) and Lin & Lis' (2011) results, although the latter use gross R&D expenditure as measurement. On this basis, I would argue that this finding is very much in line with Mazzucatos' argument about the State's major role in the "green industrialized revolution". The State is well equipped to fund early projects that develop or research potential game changers such as CCS, that are highly uncertain and in need of cost-reduction to be a viable option. These are technologies that most climate scenarios count on if we are to have any hope of reaching stringent climate goals. It is thus likely that the government is one of few actors that can provide the financial backing for R&D programmes where there are (yet) few commercialized incentives to keep researching.

If we grant these assumptions, based on the evidence presented, then there is all the more reason to think that the success and failures of explorative and experimental R&D programs will be crucial for the advances in many current and future environmentally-related technologies that we will depend on towards a low-carbon future and sufficient protection of the environment. On the political side, my interpretation of the evidence leads me to think that public R&D expenditure is not mutually exclusive to any other policy approach with the goal of reducing emissions. If R&D is also seen as a prerequisite for innovation and competitiveness as well as a way to meet climate goals, then we would expect countries to continue to fund national research as well as engaging in prestigious international collaboration to increase the effectiveness, recruitment, funding and avoid duplication of R&D activities.

This seems apparent in the aftermath of COP21 in Paris, through initiatives like Mission Innovation and other publicly funded R&D programs. According to Moe (2015) there has been an increasing awareness from that successful R&D can lead to better national competitiveness and new business opportunities, with some very real economic consequences if countries are not paying attention to these opportunities. This fact seems ever more present as we move towards a clean energy transition, as new green business and industry can create new jobs and economic growth. Mission Innovations' goal is to pave the way towards researching the clean energy solutions of tomorrow. Members of the Mission Innovation initiative has pledged serious financial funding for clean energy and other environmentally-related R&D in the next five years with a goal of doubling their clean energy R&D by 2021. It is a testament that world leaders are now starting to take some collective action towards climate change, and funding R&D is perhaps one of the few policies most expert would agree on with very little resistance in the political system. Cho and Tobin (2010) also supports this view, they conclude that it is likely that R&D funding is much easier to sell politically, than for instance harsh regulations. The evidence from studying Norway also points to this. Few are particularly against spending money on R&D. It is often a question of how much you are willing to fund, but nevertheless, the expansion of the FMEs in Norway signal a continued strategy from the Norwegian government to fund environmentally-related R&D programmes.

The model clearly shows that R&D expenditure has a significant negative relationship with GHG emissions in the OECD, and while I can only infer on the basis of the observed countries in the OECD, the result is quite clear and they imply that success of R&D progammes will be a vital component transiting towards a clean energy revolution. The IEA 2D-scenario points out that the transition of the energy sector is crucial and it also counts on the successful implementation of several uncertain technologies, especially CCS, where I believe governmental R&D commitment will be critically important.

5.3 Should technology and innovation policy be at the core of climate policy?

Finally, my analysis show that there is a significant negative relationship between technology diffusion and greenhouse gas emissions at the 0.01 level. These results imply that my hypothesis that: *Technology and innovation policy leads to reduced greenhouse gas emissions* holds. Since this variable is part of the interaction variable, we can infer that R&D acts as an extra effect on technology diffusions negative effect on GHG emissions (i.e. more R&D expenditure, more diffusion). When interpreting these results, it is useful to remember that my intent is to establish a measure of diffusion and in extension, use it as a proxy measure of where technology and innovation policy has been successful in reducing GHG emissions in the OECD. There are some obvious weaknesses of using patent statistics, but I would argue that there are not many other measurements that would give some reasonable proxy measurement of this, and to my knowledge there are no other empirical studies that use this measurement as a proxy for technology policy's effect on GHG emissions. Thus, one plausible way of looking at these results are that building support systems and policy towards the diffusion of environmentally related technologies have a transformative effect as increased diffusion of new technology, like for instance, renewable energy will immediately reduce GHG emissions, in other words – because they actually deal with the root of the problem.

This interpretation would be in line with why we would be better off having technology and innovation supporting policies at the core of climate policy. And from what we know is that the most successful of these policies have thus far been feed-in-tariffs and regardless of known problems, incentives for people to buy EVs. This does not however mean they are the most cost effective, but that is another discussion. Although EVs have had very little impact on GHG emissions yet, they will nevertheless be an important factor in reducing demand for oil in the next decades. By 2040, Bloomberg New Energy Finance estimate that EVs will account for 35 percent of new light-duty vehicle sales worldwide and about account about 25 percent of the global car fleet (New Energy Outlook, 2016).

Finally, as a word of caution I would again emphasize that the interaction variable has a p-value of 0.066, thus there are some warranted uncertainty surrounding the significance of this finding, and that any conclusions are drawn with caution and awareness that this effect might be due to coincidences.

Of the control variables only renewable energy consumption was statistically significant, showing a negative relationship with GHG emission. This result also points towards diffusion as deployment of renewable energy would lead to an increase of energy consumption coming from these sources. The other control variables were not statistically significant in the regression model, and since they are control variables I will not further discuss these variables.

One plausible interpretation of the regression model output as a whole that would be in line with Anthony Patts' sidetrack argument; market-based instruments, like taxes and cap-and-trade have not been particularly effective and so far (and perhaps never will) been a sidetrack – MBIs does not lead to systemic change. And in fact, there are other approaches that have proved much more effective. By this account, one could infer that R&D and technology diffusion is likely to have more transformative effect on the system, and could for this very reason, be why these effects appear to have a significant negative effect on greenhouse gas emissions in the model.

I have now discussed the three policy approaches that I have analyzed in this thesis, and while I won't attempt to predict the future, the evidence in the analysis points towards the fact that, it is hard not to see governmental R&D expenditure and technology and innovation polices as part of the solution.

5.4 Every solution has problems and trade-offs

Does the above mean that we have found the answer to the climate problem? Is it all about technology diffusion? R&D? Should we phase in renewable energy as fast as possible? The answer to that is that clearly the world is more complex. While one might expect that rapid diffusion of renewable energy would be a very positive thing in general, this has not been without its drawbacks. The IEA and IPCC scenarios that are in line with the 2°C target all imply that the transformation of the energy sector is necessary, but there have been some very real problems with the support policy schemes we have thus far tried out in order to get us there. Take for instance the German feed-in-tariff system, where its success may well have been its downfall. While it is not the intention here to bring in large amounts of new empirical material in the conclusion, there are a number of things that we know about these processes from other countries, suggesting that even if this has been the most effective means of reducing GHGs so far, it is no fast and easy solution. What we for instance know from Germany, which is one of the countries that has come the farthest in terms of implementing renewable energy, is that the FIT has been so effective in large parts because it has been very lucrative and as a result, very expensive for the German taxpayer. As Germany now moves on from FITs, there are some very important lessons to be learned. I will present some problematic features of FITs that we likely have to solve in order to scale up renewable energy sustainably into the energy system towards a clean energy transition. Some of these known problems are; grid-coordination, intermittencies, baseload and the bankruptcy of the current utility business model (see for instance Moe, 2015; The Economist, 2013).

Successful and sustainable integration of new wind and solar technology to the electrical grid requires solving gridline coordination problems, e.g. renewable energy pushing out natural gas before coal. There are several ways around this, and many of these point to grid infrastructure renewal. Solar and wind are also intermittent, thus without sufficient storage capability, they will not provide the necessary baseload we depend on for reliable power. In such a system, there will always be a need for back-up capacity. Here, gas has the advantage over coal and nuclear power generation, because it can be easily switched on and off, while nuclear and coal power plants require a lot of energy to start generation electricity and are therefore better left on at a steady pace. The gas industry uses this back-up capacity argument as leverage for their continued relevance in the future energy-mix. These are some very important issues that have to be solved before we can scale up to the point where our current energy system can fully transform into a clean energy system.

Finally, in several places with FITs and other support policy schemes there have been crashes in the wholesale market, like in Germany leading to a whole range of problems for major utilities that have record losses and has led to high energy prices. So we also have to rethink the utility business model in a world where renewable energy is becoming the norm. These problems are by no means descriptive of every country with FITs, Denmark for instance, seems to have solved most of these problems by using their integrated access to the Norwegian grid to use as their "battery storage" (see for instance Patt, 2015), but it is questionable if this strategy is sufficient enough for a larger country like Germany, although a high-voltage direct current (HVDC) interconnector is currently being built between Norway and Germany, called NordLink is scheduled to be operational in 2020 (Statnett, 2016).

As I have previously discussed, the German FIT scheme have turned out to be very expensive for the German taxpayer, and this lead to another important question about this policy. How sustainable are support schemes that rely on a fixed price/premium mechanism in the long-term? Without any "near real time" price signal mechanisms, governments will have a hard time adjusting prices for projects. As Mendonça, Jacobs & Sovacool (2009) conclude, adequate price adjustment is one of the most critical component of successful FITs. Without the adequate assessment of price signals, the government runs the risk of having projects that are too lucrative at the expense of the taxpayer. The fact that Germany is now moving on from FITs gives a strong indication that FITs might be the best way to deploy renewable energy technology, but only up to a critical point, unless serious consideration to grid infrastructure, some form of energy storage and other related problems are also handled simultaneously. Germany is by 2017 now scheduled to move from FITs toward another policy approach that I have not analyzed in this project, called Renewable Energy Auctions (REA). REA is a marked-based approach, akin to the Norwegian/Swedish Green Certificate Scheme where the government calls a tender to install a given capacity of renewable energy. Developers can then submit bids with a price per unit of electricity, that for instance can be measured in cents/KWh, which they will be able to realize the project. The government then evaluates and sign an agreement with the successful bidder (IRENA & CEM, 2015).

My statistical analysis only tests one form of marked-based instruments, and that is environmental taxes and from the evidence presented here, it seems likely that these taxes have not produced sufficient emission reduction in the OECD. On the basis of the mechanisms described in the theoretical section and on the basis of expert interviews and the qualitative study as a whole, it is also likely that this applies to cap-and-trade, such as the EU ETS. That being said, I can only assume as much, because cap-and-trade follow much of the same logic and mechanisms as environmental taxes, so I would cautiously infer that cap-and-trade schemes are likely to run into the same problems as taxes. There are however many other types of marked-based solutions, whom I have briefly covered in pervious chapters. And while I argue that both the qualitative and quantitative evidence show that MBIs like taxes and cap-and-trade have not produced the desired outcomes, this does not necessarily extend to all marked-based approaches. As I have mentioned in relation to Germany, there are actually some very encouraging signs from the fairly new practice of REA. In 2008, only 8 countries used REA, and in 2016 that number is now over 60 (Bloomberg New Energy Finance, 2016). As mentioned, these auctions are akin to the Green Certificate scheme that is in place in Norway and Sweden. The Norwegian experience thus far with Green Certificates has been that most of the renewable installation has been in Sweden (Winther, 2015). And according to one of my respondents, from a nature conservation viewpoint, that might be preferable. After all, Norway is already close to being hundred percent covered by renewable energy. And while there are known problems with REAs such as underbidding and unrealized projects, fresh numbers from Bloomberg New Energy Finance (April 2016) show that they have auctioned projects that will produce wind power at 4 cents/KWh in Morocco and a solar PV project for 3.4 cents/KWh in Mexico with projected start-up in 2018 (Bloomberg New Energy Finance, 2016), and these numbers are quite frankly remarkable. The advantage of REAs or Green Certificates over FITs seem to be that they are much more linked with the market price signals, and it will the project developer that assesses the project costs and risk, not the government.

So while feed-in-tariffs provides us with the best historical example of successful technology and innovation policy yet, there are some major hurdles to overcome for rapid diffusion to be the solution. Because of these problems, new innovative policy approaches are being tested and some, like REAs are looking quite promising. With governmental R&D, perhaps the only real problem is that it likely won't have any immediate effect, but rather help realize and trying to find solutions to problems that we might have in the mid to long-term future. R&D is after all but the first step in the long chain before commercialization, and thus we need to have realistic expectations for the immediate effect of R&D programmes.

To sum it up, my evidence points in the direction of Patts' argument that instead of wasting more time trying to punish the old system, we are perhaps better off devoting our efforts towards supporting the new. And while support policies might not be the most cost-effective and have the most desirable effects – they seem to be easier to implement and diffusion has an immediate effect on emissions.

5.5 Technological advances and other x-factors

I have now discussed why I believe that technology and innovation supporting policies and governmental R&D will be part of the solution of how we deal with climate change. I have also discussed why I think there are some serious hurdles to overcome if we are going in this direction – that, as with every solution, there will be trade-offs. Some, like Bill Gates think we need an energy miracle, and in February 2016 he even made a prediction that "Within the next 15 years—and especially if young people get involved—I expect the world will discover a clean energy breakthrough that will save our planet and power our world" (Gates & Gates, 2016). While others like the Chairman of Bloomberg New Energy Finance, Michael Liebreich that believe that the "energy miracle" Gates is looking for already is here, and that we even got *two* – namely solar PV and wind. With their incredible cost-reduction and unprecedented learning curves he, like Anthony Patt, believes that the world already has the technology that will transform the energy system completely. But the one thing that will really enable us to utilize the full range of support polices to scale up and solve some of the problems with renewable energy will be advances in energy storage. Finally, I want to discuss some uncertain but potential game changer that might be help bring about the transition towards an emissions-free energy system, as well as the so-far underestimated and neglected proposition of pollution from renewables.

5.6 Energy Storage

As I have pointed out, there are several potential problems with massive deployment of renewable energy technology today and even the most optimistic environmentalist will have to concede that if the future energy system is to be built around renewables, there are some important technological advances that have to take place. Those who believe that demand for fossil-based energy will be high in many decades to come, are partly calculating this on the basis that with renewable energy as the primary source of power production, it will require significant back-up capacity.

Therefore, one of the major game changers on this front will be whether or not we are will have sufficient advances in energy storage. There are several forms of energy storage, one option, like in Norway is using a combination of reservoir and pumped hydropower as a sort of energy storage and if extra capacity is needed, one can phase in additional power generation and reservoirs works well as seasonal storage. Then you have several small-scale energy storage options, like chemical and thermal energy storage, like hydrogen (electrolysis) and solar-thermal systems. Finally, and probably the golden nut to crack, is battery storage, or electrochemical storage.

By many experts' accounts, improved energy storage in form of high capacity battery storage technology can be the real game-changer for the clean energy transition, and without it we will have to continue to rely on reliable back-up alternatives like gas power plants. And there are some very global and influential actors working on improving battery storage technologies. The global application for advances in energy storage is enormous. In Germany for instance, only a fraction of Germans with solar panels have installed storage systems, a marked that is expected to grow rapidly with declining costs and improved performance for battery systems. With improved capacity at lower costs, batteries will have a whole range of commercialized application in a wide specter of sectors, not only the energy sector (Parkin, 2016). Already companies like Tesla, GE and other major tech-companies that are working hard to practically eliminate the gas industry's back-up capacity argument (Tesla Motors, 2016; sonnen-Batterie, 2016). Therefore, it seems likely that there will be a rush to develop new battery and storage technology, with serious R&D commitment from both the State and private enterprise. With advances in energy storage, there is therefore hope that we can deal with some of the larger issues relating to scaling up diffusion, issues such as intermittencies, baseload, and coordination. For EVs, battery technology will also be a very important factor if they are going to compete with cars with combustion engines and like-vise for battery technology, the rise of EVs will significantly reduce costs of batteries, acting as a positive feedback loop for innovation and cost-reduction.

Thus, creating incentives for people to buy EVs would likely increase efforts and raise more funding towards advances in battery technology. Competitive EVs are of course, seen as a major part of reduction emissions from transport, where oil is the predominant source of fuel. And although it is very hard to predict the future, if advances in energy storage and battery technology are seen as the critical factor that will allow scaling up diffusion of clean technology and completive EVs, I would argue that this certainly points towards R&D commitment and further diffusion as energy storage, EVs entry to the mass-marked, and the successful integration of renewable energy are closely intertwined.

5.7 New energy sources and technological advances

For many scientists working with energy, the only true source of renewable energy comes from a process known as nuclear fusion. Unlike here on Earth, where the traditional nuclear power generation is produced by a process known as nuclear fission. These are two different types of energy-releasing reactions. Fission is the splitting of an atom into two or more smaller atoms, while fusion is the process in which atoms fuse together into a larger one – this is the same process that fuels the stars. And while fission produces radioactive waste that has to be very carefully managed, fusion has no harmful waste-products (World Nuclear Association, 2014; ITER, 2016a). If we manage to replicate the fusion process here on earth, we practically have unlimited renewable energy. This exciting prospect has funded the world's currently largest scientific collaboration, with China, the European Union, India, Japan, Korea, Russia and the United States. The project is called ITER (International Thermonuclear Experimental Reactor), and is located in Southern France. It will try to achieve nuclear fusion, when it is fully assembled around 2020. ITER is designed to produce 500 MW of fusion power from a 50 MW power input. If nuclear fusion is achieved, we have truly discovered the clean energy source of the future (ITER, 2016b).

I have discussed very little of the role of nuclear power generation in this project, and I will not go much into detail, but there are exiting advances in both new fission reactor models and nuclear waste-management solution. One exiting prospect in particular are molten salt reactors. Molten salt reactors have the potential to solve some of nuclear fissions' biggest problems; radioactive waste, as they destroy radioactive isotopes almost completely (Waldrop, 2012). Finally, there are some exiting prospects for hydrogen fuel cell technology, and while their application for light-duty vehicles still remain questionable, hydrogen fuel cell technology might have a future in the maritime sector. With a significant role in giving long distance shipping, such as cargo-ships and shorter-distance ships like ferries a low-carbon alternative. (Amani, 2010; Valle, 2016).

While we have much hope for renewable energy sources like Solar PV and wind, they also have waste-products that have to be dealt with. That being said, these are probably of less concern than the environmental effect of fossil-fuel technologies. It is also fair to say that the renewable energy sources of today, will most likely be very different from the energy sources we use in 50 to a 100 years from now.

The future of these technologies are all uncertain, thus one cannot have too high expectations, and unless nuclear fusion is achieved within a reasonable time frame, I believe the most important and most immediately useful technological advance has to happen in energy storage.

5.8 Improving the model

For further research of climate policy approaches, there are several options one could explore towards developing a more sophistical model. The regression analysis gives an account of the empirical pattern we might observe in the time period I have data for. So while I am quite confident that the model covers a range of important variables that we might expect affect the GHG emissions picture, these are by no means every variable that potentially effect emissions. I nevertheless believe the one of the weaknesses of the statistical model is that I lack a good control variable for energy mix. Although I control for renewable energy consumption, this is a very thin control for energy mix. For instance, my case country, Norway has a very atypical energy mix and several other OECD countries have a widely different energy mixes and my suspicion is that this could affect the regression data. In further research, this would be one variable I believe should be included if such measure is possible to quantify in a meaningful way. However, to this point – Since I use fixed effects in this model, i.e. whether temporal variation in x is associated with temporal variation in y, I am in this thesis after the broader empirical pattern in the OECD, not individual differences between countries. But I still believe an energy mix control variable would strengthen the model. In order to compare the effect of climate policy approaches on GHG emission between the OECD countries one has to use a different regression estimator called between effects. This would also be an interesting research project that could for instance, answer some important questions about how important induvial country characteristics are for the effects of various climate policy approaches on emissions.

Another weakness is the lack of control for unexpected events such as the financial crisis or international agreements like Kyoto, and one way to deal with this would be to run the regression in time intervals and then compare model results, for instance with time intervals: pre-Kyoto (e.g. 1900-1997), post-Kyoto (e.g. 1998-2007) and post-financial crisis (e.g. 2008-2012). This would of course severely reduce the number of observations in the induvial models, and would only be run as a control measure. Without sufficient experimentation and knowledge of how best to control for such events, there could be better ways to control for this as well. It is nevertheless, an interesting proposition because these "unexpected" events have the potential to affect various countries very differently. Again for my model, I am still investigating the broader trend, but it would certainly be interesting to see how these events affect the data. There is also the problem of carbon leakage, such as factories and energy intensive industry moving outside the OECD. While carbon leakage is hard to model, I have tried to control for this with the manufacturing variable in the analysis and hopefully it can provide some reasonable control. But I am nevertheless unsure if the model is sufficiently specified to control the results of carbon leakage. This would be a clear priority to investigate in future research.

I would also say that the use of patent statistics as proxy can be problematic. While the OECD and several others uses these measurements, it is difficult to quantify things such as innovation and the effects of support policies. So while tax data and governmental R&D budget appropriations are very objective and easily quantifiable, there are some underlying questions relating to the use of patents statistics in this analysis. That being said, patent statistics might be one of the few measurements that to my knowledge might provide some measurement of the effectiveness of technology and innovation policies.

Finally, the lack of control for traditional environmental approaches, such as technology or emissions standards stand out as a weakness. To my defense, such a variable is very hard to quantify. There is one variable that would be interesting to decouple and test specifically for this analysis, that just might give a reasonable measure of standards, and that is an index called *The OECD Environmental Policy Stringency Index* (EPS). The EPS measures a whole range of environmental policy indicators (OECD.Stat, 2016). One could potentially decouple some of the relevant environmental standards from this index and run them separately in the model to control for these. I did however run the entire EPS index variable together with the final model and found that it was not significant (called model 4. and can be found in Appendix B). As for the model in general, it is possible to run models with different specification, like changing from robust sandwich estimators to simple "panel corrected standard errors" for greater efficiency as suggested by Beck and Katz (1996).

5.9 Concluding remarks on the discussion

My analysis show that it is likely that R&D and diffusion of environmental related technology have reduced emissions in the OECD. And I believe one plausible interpretation of the data and the study in general (and one that might also serve as a punchline for climate policies in general), is that while it is likely that market-based instruments will get us over the line in the end, they will do so only after they become more politically feasible as our dependence on fossil based energy is reduced, and there is frankly no telling when that will be. Therefore, I suspect that it is most likely the support policies that will get the dirty work done and get us to a point where the market forces really can move the final pieces towards a clean energy transition.

6 Conclusion

The main purpose of the thesis has been to investigate whether market-based instruments like environmental taxes have been effective in reducing greenhouse gas emission in the OECD. In addition, as alternative policy approaches to market-based instruments, I have also studied the performance of governmental R&D expenditure and technology and innovation policy in reducing emissions. I have analyzed cross-country panel data for 32 OECD countries in the time period between 1990 and 2012 as well as conducted a complementary case study of Norway. The aim of the qualitative analysis has been to uncover the broader empirical trend in the OECD, while the case study would provide deeper insight about the political reality and mechanisms that can affect climate policy decisions as well as, have market-based instruments worked in a country where they have been and are at the core of the country's climate policy. By analyzing three alternative policy approaches and utilizing the strengths of the mixed method approach, I have been able to something substantial about some of the climate policy choices that are on the table for policymakers.

My analysis show that market-based instruments like environmental taxes have not been particularly effective in reducing GHG emissions in the OECD. The insight from the case study of Norway also supports this result. The results from the TSCS model show that environmental taxes exhibit a non-significant relationship with GHG emission, while governmental R&D and technology diffusion both display negative significant relationships with greenhouse gas emissions at the 0.01 level.

The lack of longitudinal data-analysis of policy approaches makes the findings in this thesis very interesting, but also makes it difficult to compare and further verify the results. With only a few studies (for instance, Cho & Tobin, 2010) that have looked at some of these variables from a quantitative perspective makes it more difficult to compare the results. Thus, one has to be cautious to conclude too much on the basis on one analysis. And even though I use an advanced statistical technique as well as case study insight there are still further investigation needed. For one, the use of patent statistics as a measurement of environmentally-related technology diffusion as a proxy of technology and innovation policies is ambiguous. As such, using a statistical approach and especially with proxy measurements to answer any question strongly imply having a solid theoretical framework in order to make plausible interpretations of the results. For my analysis, the results are very much in line with Cho & Tobin (2011), Dryzek (2013), Mazzucato (2013) and Patt (2015), thus, strengthening the plausibility of the quantitative findings in the thesis. The result is also further supported by the insight from the Norwegian case study and expert interviews.

On the basis of the evidence presented from the quantitative analysis of the OECD, and both the qualitative and quantitative study of Norway, I therefore conclude that it is likely that market-based instruments like environmental taxes have not been particularly effective at reducing greenhouse gas emission in the OECD and that there is reason to believe that governmental R&D and technology and innovation policies have been more effective.
I further conclude that one plausible explanation for these results are that, while environmental taxes might provide us with a more efficient system, they are politically very difficult to raise to a level needed to make a difference, therefore they do not produce systemic change. And if market-based instruments are a sidetrack, then perhaps we are better off supporting new technology, rather than trying to punish the old. This points in the direction of R&D and technology diffusion, and while these policies might not be the most cost-effective, they arguably have a more transformative effect.

Granted, if we see public funded R&D and technology and innovation policies as the best way to reduce emissions, it is important to remember that like with every policy approach there are problems and trade-offs. Especially, to have support policies aimed at increasing the diffusion of new technology, there are important considerations and technological advances that likely have to happen before we would be able to scale up indefinitely. The good news is that the technological advances that likely will solve some of these problems are being pursued by some very powerful and influential global actors. And the advances in energy storage will likely benefit from public funded R&D programmes as well as policies that support diffusion of new technology, with EVs and renewable energy technologies as examples.

As for the Norwegian case study, the central insight can be summed up in that the Norwegian official narrative has very much been that market-based instruments are working and that they are the most effective way of reducing emissions. But there is very little empirical evidence to back up this claim. And being one of the world's largest oil and gas exporters also makes Norway a very peculiar case because it is hard to isolate Norwegian domestic climate policy without thinking of its dependence on petroleum revenues. Thus, my concluding remarks for the Norwegian case study is that it essentially confirms the suspicion from the broader analysis, that environmental taxes are politically very hard to bring to a level needed make a difference. Although in Norway especially, in order to significantly reduce domestic GHG emissions, it practically won't matter how high the tax rates are unless there is a change in Norwegian oil and gas policies. Sooner or later the Norwegian government has to adapt its approach in a world where we are starting to see effective climate policy. In the words of of Anders Bjartnes, a Norwegian environmental journalist; Norway "need to start thinking harvesting, not expansion. The main thing is to avoid investments that are unprofitable in a world where climate policy is successful" (Bjartnes, 2015).

For future research there are several propositions to be made. Additional analysis of the policy approaches I have investigated is certainly encouraged. Further investigation on whether there exists a more refined measurement of the diffusion variable would be a good place to start. Another proposition would be to investigate the effects of clean energy R&D expenditure, although I deem it likely that it will result in similar results as in this analysis, it would nevertheless yield valuable information, especially in the wake of the Mission Innovation initiative. Furthermore, the analysis only covers three of several policy approaches aimed at reducing emissions. Therefore, an exciting prospect would be to complement this analysis with further investigation of other policy approaches, such as the effects of technology standards, green certificates schemes, and renewable energy auctions.

Finally, some concluding remarks and recommendations for policymakers. The results from this study are quite clear. However, the world is more complex and there are many factors that influence policy outcomes and with every solution, there are problems. That being said, there are some very exiting technological advances to keep an eye on, especially in energy storage. The advances there might turn things completely around. Thus, in conclusion – based on my study, I would recommend public funding of R&D programmes and extended use of support policies towards the diffusion of new technology over market-based instruments like environmental taxes.

Literature

Achen, C. H. (2000). Why lagged dependent variables can suppress the explanatory power of other independent variables. *Ann Arbor*, *1001*(2000), 48106-1248.

Adolph, C., D. M. Butler and S. E. Wilson. (2005). "Which Time-Series Cross-Section Estimator Should I Use Now? Guidance from Monte Carlo Experiments." Paper presented at the 2005 Annual Meeting of the American Political Science Association, Washington, D.C.

Alizamir, S., de Véricourt, F., & Sun, P. (2016). Efficient feed-in-tariff policies for renewable energy technologies. *Operations Research*.

Amani, Y. M. (2010). Hydrogen Based Shipping Industry. *AG11 Presentation, Pusan South Korea Oct*.

Amos, H. (2016). *Poor air quality kills 5.5 million worldwide annually.* Available at: http://news.ubc.ca/2016/02/12/poor-air-quality-kills-5-5-million-worldwide-annually/ (Accessed: 13. April 2016).

Angrist, J. D., & Pischke, J. S. (2008). *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.

Atkin, E. (2015). *Why You Should Be Skeptical of Big Oil Companies Asking for a Price on Carbon.* Available at: http://thinkprogress.org/climate/2015/06/03/3665618/oil-companies-want-carbon-price/ (Accessed: 19 February 2016).

Avi-Yonah, R. S., & Uhlmann, D. M. (2009). Combating global climate change: Why a carbon tax is a better response to global warming than cap and trade. *Stanford Environmental Law Journal*, *28*(3).

Baranzini, A., Goldemberg, J., & Speck, S. (2000). A future for carbon taxes. *Ecological economics*, *32*(3), 395-412.

Baumol, W. J., & Oates, W. E. (1988). *The Theory of Environmental Policy*. Cambridge University Press.

Beck, N., & Katz, J. N. (1996). Nuisance vs. substance: Specifying and estimating time-series-cross-section models. *Political analysis*, *6*(1), 1-36.

Beck, N. (2001). Time-series-cross-section data: What have we learned in the past few years?. *Annual review of political science*, *4*(1), 271-293.

Beck, N., & Katz, J. N. (2004, July). Time-series-cross-section issues: dynamics, 2004. In *annual meeting of the Society for Political Methodology, Stanford University.*

Beck, N. (2008). "Time-Series Cross-Section Methods" in Janet M. Box - Steffensmeier, Henry E. Brady, & David Collier (eds.) *The Oxford Handbook of Political Methodology*. Oxford: Oxford University Press: 475–493.

Bjartnes, A. (2015a). *Det Grønne Skiftet. Stans Norges veddemål mot klimapolitikken*. 1. Ed. Oslo: Frekk Forlag.

Bjartnes, A. (2015b). *Det grønne skiftet.* Available at: http://energiogklima.no/blogg/bjartnes/det-gronne-skiftet/ (Accessed: 12. May 2016).

Bloomberg New Energy Finance. (2016). *Bloomberg New Energy Finance Summit – In search of the miraculous.* Available at: http://about.bnef.com/content/uploads/sites/4/2016/04/BNEF-Summit-Keynote-2016.pdf (Accessed: 10. June 2016).

Bloomberg View (2015). *Even Big Oil Wants a Carbon Tax.* Available at: http://www.bloombergview.com/articles/2015-06-01/even-big-oil-wants-a-carbon-tax (Accessed: 18 February 2016).

Bruvoll, A., & Larsen, B. M. (2004). Greenhouse gas emissions in Norway: do carbon taxes work?. *Energy policy*, *32*(4), 493-505.

Burch, S. L., & Harris, S. E. (2014). *Understanding climate change: science, policy, and practice*. University of Toronto Press.

Christiansen, A. C. (2001). Climate policy and dynamic efficiency gains A case study on Norwegian CO2-taxes and technological innovation in the petroleum sector. *Climate Policy*, *1*(4), 499-515.

Christiansen, A.C. (2002). New renewable energy developments and the climate change issue: a case study of Norwegian politics, *Energy Policy,* 30(3), s. 235-243.

Christophersen, K.A. (2013). *Introduksjon til statistisk analyse – Regresjonsbaserte metoder og anvendelse.* 1.ed. Oslo: Gyldendal akademisk.

Couture, T., & Gagnon, Y. (2010). An analysis of feed-in tariff remuneration models: Implications for renewable energy investment. *Energy policy*, *38*(2), 955-965.

Couture, T. D., Cory, K., Kreycik, C., & Williams, E. (2010). *Policymaker's guide to feed-in tariff policy design* (No. NREL/TP-6A2-44849). National Renewable Energy Laboratory (NREL), Golden, CO.

Daugbjerg, C., & Svendsen, G. T. (2003). Designing green taxes in a political context: From optimal to feasible environmental regulation. *Environmental Politics*, *12*(4), 76-95.

Dickey, D. A., & Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, *74*(366), 427–431.

Dooley, J., & Runci, P. (1999). *Adopting a long view to energy R&D and global climate change*. Pacific Northwest National Laboratory.

Doyle, A. (2016). *Norway's greenhouse gas emissions rise, despite promised cuts.* Available at: http://www.reuters.com/article/us-norway-carbon-idUSKCN0YB12E (Accessed: 29. May 2016).

Dryzek, J. S. (2013). *The politics of the earth: Environmental discourses*. 3.ed. Oxford University Press.

EEA. (1996), *Environmental Taxes. Implementation and Environmental Effectiveness,* Copenhagen: European Environmental Agency.

Energi og klima. (2016). *Norges utslipp – klimagassutslipp siden 1990.* Available at: http://energiogklima.no/klimavakten/norges-utslipp/ (Accessed: 29. May 2016).

EPA. (2015). *Overview of greenhouse gases.* Available at: http://www3.epa.gov/climatechange/ghgemissions/gases.html (Accessed: 10 October 2015).

Eskeland, G. S., & Jimenez, E. (1992). Policy instruments for pollution control in developing countries. *The World Bank Research Observer*, *7*(2), 145-169.

European Commission. (2008). *Commission staff working document - The support of electricity from renewable energy sources.* Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52008SC0057 (Accessed: 20. April 2016).

European Commission. (2016). *The EU Emission Trading System (EU ETS).* Available at: http://ec.europa.eu/clima/policies/ets/index_en.htm (Accessed: 21. April 2016).

Eurostat. (2008). *Comparison between NABS 2007 and NABS 1992.* Available at: http://www.oecd.org/science/inno/43299905.pdf Accessed: 28 September 2015).

Fearon, J. D., & Laitin, D. D. (2008). *Integrating qualitative and quantitative methods* (pp. 756-76). na.

Frascati Manual. (2002). *Proposed Standard Practice for Surveys on Research and Experimental Development.* Available at: http://www.oecd-ilibrary.org/docserver/download/9202081e.pdf?expires=1464786483&id=id&accname=guest&checksum=A39D8B641AF155931014FE6EB34E5206 (Accessed: 1. October 2015).

Fullerton, D., & Metcalf, G. E. (1997). *Environmental taxes and the double-dividend hypothesis: Did you really expect something for nothing?* (No. w6199). National Bureau of Economic Research.

Gardner, D. K. (2014). *China's Environmental Awakening.* Available at: http://www.nytimes.com/2014/09/15/opinion/chinas-environmental-awakening.html (Accessed: 16. April 2016).

Gates, B. & Gates, M. (2016). *Our 2016 Annual Letter.* Available at: https://www.gatesnotes.com/2016-Annual-Letter (Accessed: 10. June 2016).

Goldenberg, S. (2014). *Canada switches on world's first carbon capture power plant*. Avaliable at: http://www.theguardian.com/environment/2014/oct/01/canada-switches-on-worlds-first-carbon-capture-power-plant (Accessed: 9. February 2016).

Griliches, Z. (1990). *Patent statistics as economic indicators: a survey* (No. w3301). National Bureau of Economic Research.

Hahn, R. W. (1989). Economic prescriptions for environmental problems: how the patient followed the doctor's orders. *The Journal of Economic Perspectives*, *3*(2), 95-114.

Hall, B. H. (2013). Using patent data as indicators. In *the European Meeting on Applied Evolutionary Economics, Sophia Antipolis, France*.

Hancké, B. (2009). *Intelligent Research Design – A guide for Beginning Researchers in the Social Sciences.* Oxford: Oxford University Press.

Hansen, J., Sato, M., Kharecha, P., Russell, G., Lea, D. W., & Siddall, M. (2007). Climate change and trace gases. *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences*, *365*(1856), 1925-1954.

Harvey, F. (2011). *Worst ever carbon emissions leave climate on the brink.* Available at: http://www.theguardian.com/environment/2011/may/29/carbon-emissions-nuclearpower (Accessed: 5 November 2015).

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the Econometric Society*, 1251-1271.

Havnes, H. (2016). *Oljefondet ut av 52 kullselskaper.* Available at: http://www.dn.no/nyheter/energi/2016/04/14/1218/oljefondet-ut-av-52-kullselskaper (Accessed: 23. May 2016).

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *Stata Journal*, *7*(3).

Holter, M. (2016). *World's Biggest Wealth Fund Faces Wider Ban on Coal Investments.* Available at: http://www.bloomberg.com/news/articles/2016-05-22/world-s-biggest-wealth-fund-faces-wider-ban-on-coal-investments (Accessed: 22. May 2016).

Holtsmark, B., & Skonhoft, A. (2014). The Norwegian support and subsidy policy of electric cars. Should it be adopted by other countries?. *Environmental science & policy*, *42*, 160-168.

Hoyle, R & Taylor, R. (2014). *Australia Becomes First Developed Nation to Repeal Carbon Tax*. Available at: http://www.wsj.com/articles/australia-repeals-carbon-tax-1405560964 (Accessed: 10 February 2016).

IEA. (2010). *Energy Technology Perspectives. Scenarios & Strategies to 2050*. Available at: https://www.iea.org/publications/freepublications/publication/etp2010.pdf (Accessed: 10. January 2016).

IEA. (2012). *Energy Technology Perspectives*. Available at: https://www.iea.org/publications/freepublications/publication/ETP2012_free.pdf (Accessed: 21. January 2016).

IEA. (2013). *Technology Roadmap: Carbon Capture and Storage 2013.* Available at: http://www.iea.org/publications/freepublications/publication/technology-roadmap-carbon-capture-and-storage-2013.html (Accessed: 20. March 2016).

IEA. (2014). *World Energy Outlook – Executive Summary*. Available at: http://www.iea.org/Textbase/npsum/WEO2014SUM.pdf (Accessed: 18. January 2016).

IEA. (2016a). *Scenarios and Projections.* Available at: http://www.iea.org/publications/scenariosandprojections/ (Accessed: 27 February 2016).

IEA. (2016b). *Key Electricity Trends 2015 – Based on Monthly Data.* Available at: http://www.iea.org/media/statistics/Keyelectricitytrends2015.pdf (Accessed: 07. May 2016).

IMF. (2015). *IMF and the Environment.* Available at: http://www.imf.org/external/np/fad/environ/ (Accessed: 10 October 2015).

Investopedia. (2016). *Monte Carlo Simulation.* Available at: http://www.investopedia.com/terms/m/montecarlosimulation.asp (Accessed: 05. June 2016).

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Available at: http://www.ipcc.ch/report/ar5/wg1/ (Accessed: 20 October 2015).

IRENA & CEM. (2015). *Renewable Energy Auctions – A Guide to Design.* Available at: http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Auctions_Guide_2015_2_policies.pdf (Accessed 7. June 2016).

ITER. (2016a). *Fusion.* Available at: http://www.iter.org/sci/whatisfusion (Accessed: 10. June 2016).

ITER. (2016b). *What is ITER?* Available at: http://www.iter.org/proj/inafewlines#3 (Accessed: 10. June 2016).

Jakobsen, T.G. (2013). *Time-Series Cross-Section Analysis.* Available at: http://www.popularsocialscience.com/2013/07/30/time-series-cross-section-analysis/ (Accessed: 13. April 2016).

Jakobsen, T.G. (2015a). Panel Data Analysis: Computer Lab #4 [PDF]. Available at: http://www.svt.ntnu.no/iss/Arild.Blekesaune/SOS8515-filer/Panel_Lab4.pdf.

Jakobsen, T.G. (2015b). Panel Data Analysis: Computer Lab #2 [PDF]. Available at: http://www.svt.ntnu.no/iss/Arild.Blekesaune/SOS8515-filer/Panel_Lab2.pdf.

Johnstone, N., Haščič, I., Poirier, J., Hemar, M., & Michel, C. (2012). Environmental policy stringency and technological innovation: evidence from survey data and patent counts. *Applied Economics*, *44*(17), 2157-2170.

Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: a guide for macroeconomists. *Economics letters*, *65*(1), 9-15.

Kasa, S. (2000). Policy networks as barriers to green tax reform: The case of CO2-taxes in Norway. *Environmental Politics*, *9*(4), 104-122.

Kete, N. (1994). Environmental policy instruments for market and mixed-market economies. *Utilities Policy*, *4*(1), 5-18.

Khemani, R. S., & Shapiro, D. M. (1993). *Glossary of Industrial Organisation Economics and Competition Law.* Available at: http://www.oecd.org/regreform/sectors/2376087.pdf (Accessed: 14. March 2016).

KonKraft. (2016). *Nordover – Norsk sokkel i endring.* Available at: http://konkraft.no/wp-content/uploads/2016/04/Nordover-norsk-sokkel-i-endring.pdf (Accessed: 24. May 2016).

Lallanilla, M. (2015). *Greenhouse Gas Emission: Causes and Sources.* Available at: http://www.livescience.com/37821-greenhouse-gases.html (Accessed: 10 November 2015).

Lie, Ø. (2016). *Norske utslipp av klimagasser.* Available at: http://www.tu.no/artikler/mangearig-trend-er-brutt-norske-utslipp-av-klimagasser-okte-i-fjor/347371 (Accessed: 24. May 2016).

Limousin, L. (2010). *CCS communication: lessons learnt from Barendrecht.* Available at: http://bellona.org/news/ccs/2010-11-ccs-communication-lessons-learnt-from-barendrecht (Accessed: 23. April 2016).

Lin, B., & Li, X. (2011). The effect of carbon tax on per capita CO 2 emissions. *Energy policy*, *39*(9), 5137-5146.

Lovdata. (2015). *Lov om avgift på utslipp av CO_2 i petroleumsvirksomhet på kontinentalsokkelen.* Available at: https://lovdata.no/dokument/NL/lov/1990-12-21-72?q=Lov%20om%20co2 (Accessed: 14. May 2016).

Mankiw, N. G. (2007). One answer to global warming: A new tax. *The New York Times*, *7*(16), 09.

Mazzucato, M. (2013). *The entrepreneurial state: Debunking public vs. private sector myths*. Anthem Press.

Mendonca, M., Jacobs, D., & Sovacool, B. K. (2009). *Powering the green economy: The feed-in tariff handbook*. Earthscan.

Ministry of Climate and Environment. (2012). *Klimaforliket vedtatt i Stortinget.* Available at: https://www.regjeringen.no/no/aktuelt/klimaforliket-vedtatt-i-stortinget/id684927/ (Accessed: 20. May 2016).

Ministry of Climate and Environment. (2016). *Norske utslipp av klimagasser i 2015.* Available at: https://www.regjeringen.no/no/aktuelt/norske-utslipp-av-klimagasser-i-2015/id2501150/ (Accessed: 29. May 2016).

Ministry of Finance. (2007) *The history of green taxes in Norway.* Available at: https://www.regjeringen.no/en/topics/the-economy/taxes-and-duties/The-history-of-green-taxes-in-Norway/id418097/ Accessed: 20. May 2016).

Ministry of Finance. (2015). *Report from the green tax commission.* Available at: https://www.regjeringen.no/en/aktuelt/report-from-the-green-tax-commission/id2466332/ (Accessed: 23. May 2016).

Ministry of Finance. (2016a). *Revised National Budget 2016.* Available at: https://www.regjeringen.no/contentassets/94d2e052d80c48b1a59e093ded80d324/no/pdfs/stm201520160002000dddpdfs.pdf (Accessed: 18. May 2016).

Ministry of Finance. (2016b). *Avgiftsatser 2016.* Available at: http://www.statsbudsjettet.no/Statsbudsjettet-2016/Artikler/Avgiftssatser-2016/ (Accessed: 19. May 2016).

Ministry of Petroleum and Energy. (2011). *Fornybardirektivet en del av EØS-avtalen.* Available at: https://www.regjeringen.no/no/aktuelt/fornybardirektivet-en-del-av-eos-avtalen/id667482/ (Accessed: 23. May 2016).

Ministry of Energy and Petroleum. (2014a). *Avviklingsavtale for fullskalaprosjektet på Mongstad signert.* Available at: https://www.regjeringen.no/no/aktuelt/Avviklingsavtale-for-fullskalaprosjektet-pa-Mongstad-signert/id758225/ (Accessed: 20. May 2016).

Ministry of Petroleum and Energy. (2014b). *Elsertifikatordningen.* Available at: https://www.regjeringen.no/no/tema/energi/fornybar-energi/elsertifikater1/id517462/ (Accessed: 23. May 2016).

Ministry of Petroleum and Energy. (2015). *23 round: New, major opportunities for Northern Norway.* Available at: https://www.regjeringen.no/en/aktuelt/new-major-opportunities-for-northern-norway/id2362200/ (Accessed: 27. May 2016).

Mission Innovation. (2016). *About Mission Innovation.* Available at: http://mission-innovation.net/about/ (Accessed: 10. June 2016).

Moe, E. (2015). *Renewable Energy Transformation or Fossil Fuel Backlash: Vested Interests in the Political Economy*. Palgrave Macmillan.

Moses, J. W., & Knutsen, T. L. (2012). *Ways of knowing. Competing Methodologies in Social and Political Research.* 2.ed. Basingstoke & New York: Palgrave Macmillan.

Nader, R., & Heaps, T. (2008). *We Need a Global Carbon Tax - The cap-and-trade approach won't stop global warming.* Available at: http://www.wsj.com/articles/SB122826696217574539 (Accessed: 10. June 2016).

Nakicenovic, N., & Swart, R. (2000). Special report on emissions scenarios. *Special Report on Emissions Scenarios, Edited by Nebojsa Nakicenovic and Robert Swart, pp. 612. ISBN 0521804930. Cambridge, UK: Cambridge University Press, July 2000.*, *1*.

New Energy Outlook. (2016). *Bloomberg New Energy Finance – New Energy Outlook 2016 Executive Summary 2016.* Registered access at: http://www.bloomberg.com/company/new-energy-outlook/#form (Accessed 16. June 2016).

Norsk olje & gass. (2016). *EU – Norsk gass er svært viktig.* Available at: https://norskoljeoggass.no/no/Nyheter/2016/02/EU-Norsk-gass-er-svart-viktig/ (Accessed: 27. May 2016).

Norsk Petroleum. (2016). *Utslipp til luft.* Available at: http://www.norskpetroleum.no/miljo-og-teknologi/utslipp-til-luft/ (Accessed: 12. May 2016).

Norwegian Petroleum Directorate. (2015). *Invitation to apply for petroleum production licences.* Available at: http://www.npd.no/Global/Engelsk/2-Topics/%5bLicence-awards%5d/23-round/Invitation2015.pdf (Accessed: 27. May 2016).

NOU 2015: 15. *Sett pris på miljøet - Rapport fra grønn skattekommisjon*. Available at: https://www.regjeringen.no/contentassets/38978c0304534ce6bd703c7c4cf32fc1/no/pdfs/nou201520150015000dddpdfs.pdf (Accessed: 3 March 2016).

NSIDC. (2016). *Thermodynamics: Albedo.* Available at: https://nsidc.org/cryosphere/seaice/processes/albedo.html (Accessed: 02. June 2016).

NVE. (2015). *Vannkraft.* Available at: https://www.nve.no/energiforsyning-og-konsesjon/vannkraft/ (Accessed: 10. May 2016).

NVE. (2016). *Elsertifikater.* Available at: https://www.nve.no/energiforsyning-og-konsesjon/elsertifikater/ (Accessed: 28. May 2016).

Nyman, P. (1998). *Environmental Taxes - The Case of Sweden* (No. HDOCPA-1998-12). Human Development Report Office (HDRO), United Nations Development Programme (UNDP).

OECD. (1997). *Environmental Taxes and Green Tax Reform*, Paris: Organization for Economic Co-operation and Development.

OECD. (2001a). *Glossary of Statistical Terms - Emission Standard.* Available at: https://stats.oecd.org/glossary/detail.asp?ID=763 (Accessed: 20. May 2016).

OECD. (2001b). *Glossary of Statistical Terms – Polluter-Pays-Principle*. Available at: https://stats.oecd.org/glossary/detail.asp?ID=2074 (Accessed: 31 March 2016).

OECD. (2003). *Glossary of Statistical Terms – Externalities.* Available at: https://stats.oecd.org/glossary/detail.asp?ID=3215 (Accessed: 30. March 2016).

OECD. (2007). *Innovation and Growth – Rationale for an Innovation Strategy.* Available at: http://www.oecd.org/science/inno/39374789.pdf (Accessed: 15. June 2016).

OECD. (2008). *OECD environmental performance Reviews – Turkey.* Available at: http://www.oecd-ilibrary.org/docserver/download/9708081e.pdf?expires=1448041003&id=id&accname=ocid42012887&checksum=2D70E59791AC5DE5C3F4550612BA8464 (Accessed: 09 November 2015).

OECD. (2012). *OECD Science, Technology and Industry Outlook 2012.* Available at: http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-science-technology-and-industry-outlook-2012_sti_outlook-2012-en#page218 (Accessed: 17. March 2016).

OECD. (2013). *OECD Environmental Performance Reviews – Mexico.* Available at: http://www.oecd.org/env/country-reviews/EPR%20Highlights%20MEXICO%202013%20colour%20figures.pdf (Accessed: 7 November 2015).

OECD. (2014). *OECD Science, Technology and Industry Outlook 2014 (Summary in English).* Available at: http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-science-technology-and-industry-outlook-2014/summary/english_4b88d3e1-en#page1 (Accessed: 13. March 2016).

OECD. (2015). *Environment at a Glance 2015 – OECD Indicators.* Available at: http://www.oecd-ilibrary.org/docserver/download/9715091e.pdf?expires=1448643388&id=id&accname=guest&checksum=3139952F97EB7ABEF7A04FDA683C179C (Accessed: 10 October 2015).

OECD.Stat. (2015a). *Greenhouse gas emissions (thousand tonne of CO2 eq).* Available at: http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=AIR_GHG&ShowOnWeb=true&Lang=en (Accessed: 15 September 2015).

OECD.Stat. (2015b). *Environment database – Instruments used for environmental policy.* Available at: http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=ENV_ENVPOLICY&ShowOnWeb=true&Lang=en (Accessed: 20 September 2015).

OECD.Stat. (2015c). *Government budget appropriations for RD.* Available at: http://stats.oecd.org/oecdstat_metadata/showmetadata.ashx?dataset=gbaord_nabs2007 (Accessed: 22 September 2015).

OECD.Stat. (2015d). *Dataset: Environment database Technology diffusion.* Available at: http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=PAT_DIFF&ShowOnWeb=true&Lang=en (Accessed: 20 October 2015).

OECD.Stat. (2016). *Environmental Policy Stringency Index.* Available at: https://stats.oecd.org/Index.aspx?DataSetCode=EPS (Accessed: 05. April 2016).

OECD.Stat. (no date). *OECD.Stat.* Available at: http://stats.oecd.org (Accessed: 10 September 2015).

Office of the Prime Minister. (2007). *Statsministerens Nyttårstale 2007.* Available at: https://www.regjeringen.no/no/aktuelt/statsministerens-nyttarstale-2007/id440349/ (Accessed: 21. May 2016).

O'Gorman, M., & Jotzo, F. (2014). Impact of the carbon price on Australia's electricity, demand, supply and emissions. *Centre for Climate Economic & Policy Working Paper*, *1411*, 17.

Orkustofnun. (no date). *Geothermal.* Available at: http://www.nea.is/geothermal/ (Accessed: 1 November 2015).

Pahle, M. (2010). Germany's dash for coal: Exploring drivers and factors. *Energy Policy*, *38*(7), 3431-3442.

Parkin, B. (2016). *GE Ventures Buys Stake in German Sonnen to Boost Solar Storage.* Available at: http://www.bloomberg.com/news/articles/2016-06-06/ge-ventures-buys-stake-in-german-sonnen-to-boost-solar-storage (Accessed: 07. June 2016).

Parkinson, G. (2015). *Solar at grid parity in most of the world by 2017.* Available at: http://reneweconomy.com.au/2015/solar-grid-parity-world-2017 (Accessed: 20.03.2015).

Patt, A. (2015). *Transforming Energy: Solving Climate Change with Technology Policy.* 1.ed. New York: Cambridge University Press.

Pavitt, K. (1985). Patent statistics as indicators of innovative activities: possibilities and problems. *Scientometrics*, *7*(1-2), 77-99.

Petersen, T. (2004). "Analyzing Panel Data: Fixed- and Random-Effect Models" in Melissa Hardy & Alan Bryman (eds.) *Handbook of Data Analysis*. Oxford: Oxford University Press: 331–345.

Plumer, B. (2014). *Australia repealed its carbon tax — and emissions are now soaring*. Available at: http://www.energy.unimelb.edu.au/documents/australia-repealed-its-carbon-tax-—-and-emissions-are-now-soaring (Accessed: 5 march 2016).

Portney, P. R., & Stavins, R. N. (2000). *Public policies for environmental protection*. Resources for the Future.

Rabe, B. (2006). Race to the top: The expanding role of US state renewable portfolio standards. *Sustainable Dev. L. & Pol'y*, *7*, 10.

Research Council of Norway. (2016). *Forskningssentre for miljøvennlig energi (FME).* Available at: http://www.forskningsradet.no/prognett-energisenter/Forside/1222932140861 (Accessed: 27. May 2016).

Ringdal, K. (2013). *Enhet og mangfold- Samfunnsvitenskapelig forskning og kvantitativ metode* 3.ed. Bergen: Fagbokforlaget Vigmostad og & Bjørke AS.

Sbertoli, P.K. (2015). *PM: Grønn skattekommisjon misforstod oppgaven.* Available at: http://blogg.zero.no/2015/12/pm-gronn-skattekommisjon-misforstod-oppgaven/ (Accessed: 09. May 2016).

Sinn, H. W. (2008). Public policies against global warming: a supply side approach. *International Tax and Public Finance*, *15*(4), 360-394.

Sivaram, V., & Norris, T. (2016). *The Clean Energy Revolution – Fighting Climate Change with Innovation.* Available at: https://www.foreignaffairs.com/articles/united-states/2016-04-18/clean-energy-revolution (Accessed: 03. May 2016).

Shankleman, J. (2016). *World's biggest windmills now make jumbo jets look tiny – A rare look inside the giant installations being developed to withstand the world's worst climates – even the Artics.* Available at: http://www.bloomberg.com/news/features/2016-04-28/world-s-biggest-windmills-now-make-jumbo-jets-look-tiny (Accessed: 03.05.2015).

Skatteministeriet. (2015). Green Taxes, the Danish experience. *6th International Tax Dialogue Global Conference Paris 2015.*

sonnen-Batterie. (2016). *GE Ventures backs sonnen's mission to form utility of the future.* Available at: https://www.sonnen-batterie.com/en-us/ge-ventures-backs-sonnens-mission-form-utility-future (Accessed: 07. June 2016).

SSB. (2016a). *Tabell: 08940: Klimagasser, etter kilde, energiprodukt og komponent.* Available at: https://www.ssb.no/statistikkbanken/selectvarval/saveselections.asp (Accessed: 30. May 2016).

SSB. (2016b). *Utslipp av klimagasser, 2015, foreløpige tall.* Available at: http://www.ssb.no/natur-og-miljo/statistikker/klimagassn (Accessed: 24. May 2016).

SSB. (2016c). *Tabell: 10645: Miljøavgifter, etter type avgift (mill. kr).* Available at: https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&ProductId=&MainTable=MiljoAvgType&nvl=&PLanguage=0&nyTmpVar=true&CMSSubjectArea=natur-og-miljo&KortNavnWeb=miljovirk&StatVariant=&checked=true (Accessed: 25. May 2016).

Statnett. (2016). *The NordLink cable to Germany.* Available at: http://www.statnett.no/en/Projects/NORDLINK/ (Accessed: 15. June 2016).

Statoil. (2011). *Applicable laws and regulations.* Available at: http://www.statoil.com/annualreport2011/en/ouroperations/applicablelawsandregulations/pages/applicablelawsandregulations.aspx (Accessed: 14. May 2016).

Statoil. (2013a). *Sleipner West.* Available at: http://www.statoil.com/en/TechnologyInnovation/NewEnergy/Co2CaptureStorage/Pages/SleipnerVest.aspx (Accessed: 05. May 2016)

Statoil. (2013b) *In Salah.* Available at: http://www.statoil.com/en/TechnologyInnovation/NewEnergy/Co2CaptureStorage/Pages/InSalah.aspx (Accessed: 05. May 2016)

Statoil. (2015a). *Snøhvit.* Available at: http://www.statoil.com/en/OurOperations/ExplorationProd/ncs/snoehvit/Pages/default.aspx (Accessed: 05. May 2016)

Statoil. (2015b). *Sustainability – FAQ.* Available at: http://www.statoil.com/en/environmentsociety/pages/faq.aspx (Accessed: 13. May 2016).

Statoil. (2015c). *Oil and gas majors call for carbon pricing.* Available at: http://www.statoil.com/en/NewsAndMedia/News/2015/Pages/01Jun_carbon.aspx (Accessed: 15. May 2016).

Stocker, T. F., Qin, D., Plattner, G. K., Tignor, M., Allen, S. K., Boschung, J., ... & Midgley, P. M. (2013). Summary for policymakers. Climate change 2013: the physical science basis. Contribution of Working Group I to the fifth assessment report of the Intergovernmental Panel on Climate Change. *IPCC Localised*, *9*, 2013.

Statistics New Zealand. (2013). *Research and Development Survey: 2012.* Available at: http://www.stats.govt.nz/browse_for_stats/businesses/research_and_development/ResearchandDevelopmentSurvey_HOTP2012/Commentary.aspx (Accessed: 1 November 2015).

Stoneman, P., & Diederen, P. (1994). Technology diffusion and public policy. *The Economic Journal*, *104*(425), 918-930.

St.meld. nr. 64. (1981). *St.meld. nr. 65, 1981–82. Om nye fornybare energikilder i Norge.* Ministry of Petroleum and Energy, Oslo: (in Norwegian).

St.meld. nr. 71. (1984). *St.meld. nr. 71, 1984–85. Norges framtidige energibruk og – produksjon.* Ministry of Petroleum and Energy, Oslo: (in Norwegian).

St.meld. nr. 61. (1988). *St.meld. nr. 61, 1987-88. Om energiøkonomisering og energiforskning.* Ministry of Petroleum and Energy, Oslo (in Norwegian).

St.meld. nr. 41. (1994). *St.meld. nr. 41, 1994–95. Om norsk politikk mot klimaendringer og utslipp av nitrogenoksider (NO_x).* Ministry of Environment, Oslo (in Norwegian). Available at: https://www.stortinget.no/no/Saker-og-publikasjoner/Stortingsforhandlinger/Lesevisning/?p=1994-95&paid=3&wid=d&psid=DIVL516&pgid=d_0239 (Accessed: 27. May 2016).

St.meld. nr. 29. (1997) *St.meld. nr. 29, 1997–98. Norges oppfølging av Kyotoprotokollen.* Ministry of Environment, Oslo (in Norwegian). Available at: https://www.regjeringen.no/no/dokumenter/stmeld-nr-29-1998-/id191599/ (Accessed: 27. May 2016).

St.meld. nr. 29. (1998) *St.meld. nr. 29, 1998–99. Om energipolitikken.* Ministry of Petroleum and Energy, Oslo (in Norwegian). Available at: https://www.regjeringen.no/no/dokumenter/Stmeld-nr-29-1998-99-/id192287/ (Accessed: 27. May 2016).

TCM. (2010). *About TCM.* Available at: http://www.tcmda.com/en/About-TCM/ (Accessed: 14. June 2016).

Teknisk Ukeblad. (2016). *Enorme fremskritt på Mongstad: Slik la de den mislykkede "månelandingen" bak seg.* Available at: http://www.tu.no/artikler/enorme-fremskritt-pa-mongstad-slik-la-de-den-mislykkede-manelandingen-bak-seg/346801 (Accessed: 16. June 2016).

Tesla Motors. (2016). *Powerwall.* Available at: https://www.teslamotors.com/powerwall (Accessed: 05. June 2016).

The Economist. (2013). *European Utilities – How to loose half a trillion euros. Europe's electricity providers face an existential threat.* Available at: http://www.economist.com/news/briefing/21587782-europes-electricity-providers-face-existential-threat-how-lose-half-trillion-euros (Accessed: 16. June 2016).

Tobin, I., & Cho, W. (2010). Performance tools and their impact on pollution reduction: An assessment of environmental taxation and R&D. *International review of public administration*, *15*(3), 53-65.

Tripati, A. K., Roberts, C. D., & Eagle, R. A. (2009). Coupling of CO2 and ice sheet stability over major climate transitions of the last 20 million years. *science*, *326*(5958), 1394-1397.

UCAR. (2011). *Climate Modeling*. Available at: http://scied.ucar.edu/longcontent/climate-modeling (Accessed: 10 march 2016).

UNEP. (1992). *Rio Declaration on Environment and Development.* Available at: http://www.unep.org/documents.multilingual/default.asp?documentid=78&articleid=1163 (Accessed: 20. January 2016).

UNFCCC. (2014a). *Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories*. Available at: http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2 (Accessed: 8 April 2016).

UNFCCC. (2014b). *List of Annex I Parties to the Convention.* Available at: https://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php (Accessed: 28. May 2016).

UNFCCC. (2015). *Adoption of the Paris Agreement*. Available at: http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf (Accessed 10 January 2016).

UNEP. (no date). *Definitions - Short-lived climate gases.* Available at: http://www.unep.org/ccac/Short-LivedClimatePollutants/Definitions/tabid/130285/Default.aspx (Accessed: 12 October 2015).

Unger, N., Shindell, D. T., Koch, D. M., Amann, M., Cofala, J., & Streets, D. G. (2006). Influences of man-made emissions and climate changes on tropospheric ozone, methane, and sulfate at 2030 from a broad range of possible futures. *Journal of Geophysical Research: Atmospheres (1984–2012), 111(D12).*

Valle, M. (2016). *Dette kan bli Norges første bilferge på hydrogen.* Available at: http://www.tu.no/artikler/dette-kan-bli-norges-forste-bilferge-pa-hydrogen/277228 (Accessed: 15. June 2016).

Van Vuuren, D. P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., ... & Masui, T. (2011). The representative concentration pathways: an overview. *Climatic change*, *109*, 5-31.

Waldrop, M. M. (2012). Nuclear energy: Radical reactors. *Nature*, *492*(7427), 26-29.

Wang, W. C., Yung, Y. L., Lacis, A. A., Mo, T., & Hansen, J. E. (1976). Greenhouse effects due to man-made perturbations of trace gases. *Science*, *194*(4266), 685-690.

Wier, M., Birr-Pedersen, K., Jacobsen, H. K., & Klok, J. (2005). Are CO 2 taxes regressive? Evidence from the Danish experience. *Ecological Economics*, *52*(2), 239-251.

Williams, R. L. (2000). A note on robust variance estimation for cluster-correlated data. *Biometrics*, *56*(2), 645-646.

Winther, P. (2015). *Denne svenske vindmøllen har du vært med på å betale for*. Available at: http://www.aftenposten.no/norge/Denne-svenske-vindmollen-har-du-vart-med-pa-a-betale-for-43315b.html?spid_rel=2 (Accessed: 07. June 2016).

Word Bank. (2014). *Statement – Putting a Price on Carbon.* Available at: http://www.worldbank.org/en/programs/pricing-carbon (Accessed: 21 October 2015).

World Bank. (2015a). *Urban population (% of total population).* Available at: http://beta.data.worldbank.org/?indicators=SP.URB.TOTL.IN.ZS (Accessed: 10 April 2016).

World Bank. (2015b). *GDP growth (Annual %)*. Available at: http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG (Accessed: 24 September 2015).

World Bank. (2015d). *Manufacturing, value added (% of GDP)* Available at: http://beta.data.worldbank.org/?indicators=NV.IND.MANF.ZS (Accessed: 10 April 2016).

Word Bank. (2016). *Renewable Energy Consumption.* Available at: http://beta.data.worldbank.org/?indicators=EG.FEC.RNEW.ZS (Accessed 13 April 2016).

World Bank. (no date). *World Development Indicators.* Available at: http://data.worldbank.org/data-catalog/world-development-indicators (Accessed 20. September 2015).

World Nuclear Association. (2014). *Physics of Uranium and Nuclear Energy.* Available at: http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/physics-of-nuclear-energy.aspx (Accessed: 10. June 2016).

Appendix A

List of interview respondents:

Research professor at Fridtjof Nansen Institute

Advisor at Zero Emission Organization

Advisor at MISA Environmental systems analysis

Professor in Economics at NTNU

Interview guide (in Norwegian):

Litt generell info:

Fullt navn og stillingsbeskrivelse ?

Sitatsjekk?

Litt om deg og hva du gjør

Litt om prosjektet mitt

Anthony Patt bok – IPCC Summary for policymakers - Solving climate change with technology policy

Karbonskatt/grønne skatter = fikling ved marginene > har ikke ført til system endring og at det er andre policy tilnærminger som faktisk har hatt effekt, selv om disse ikke er nødvendigvis er like kostnadseffektive.

Litt om karbonskatter/grønne skatter:

Hvordan vet vi at karbonskatter funker? [vi vet det rent teoretisk, men det er altså ikke nok]

Finnes det eksempler på beslutninger vi vet at karbonskatten har påvirket?
(I så fall, har disse monnet, eller er effektene minimale?)
Mine beregninger viser at effektene (nasjonalt og internasjonalt) er svært små eller ikkeeksisterende. [og at andre ting har hatt større effekt]

1) Er du uenig?
2) Om enig, er det fordi de ikke har fått virke lenge nok? fordi skattene er for små? Eller betyr det at det er andre virkemidler som er viktigere (selv om de kanskje ikke er kostnadseffektive).

Andre policy tilnærminger

Offentlig finansiert FoU

- Hvor viktig tenker du at offentlig finansiering av FoU
  for å realisere kostbar ny teknologi? For eks CCS?
  Batteri /havvind
- Er det en rimelig antagelse at norske myndigheter er rause med forskningsmidler, men har lite å gjøre med / ønsker at markedet skal ta seg av diffusjonen?
- Kan endres med økt miljøbevissthet i form av offentlige innkjøpsrammer etc. ? LCA ?

(MISA) I og med at dere har tett samarbeid med forskningsinstitusjoner som Sintef og NTNU, har dere prosjekter som kan betegnes som FoU?– og søker dere offentlige FoU midler til dette? /hvor viktig er denne støtten?

Teknologi og innovasjonsfremmende policy

- Bør teknologipolicy være teknologinøytral eller bør vi satse på noen utvalgte teknologier?
- Hva gjør vi rett i Norge?
- Hvilke policy tiltak mener du Norge bør iverksette for å få igang det grønne skiftet ?
- Norges rolle i lavutslippssamfunnet ?

Appendix B

Model output from Outreg.stata.

Model 1: The one I use in the project, here for reference

Model 2: Same as model 1, but without interaction variables.

Model 3: Model with RDspending with Energy R&D (called: L.NewRDwithEnergy).

Model 4: Model with EPS.

	(1)	(2)	(3)	(4)
VARIABLES	Model 1	Model 2	Model 3	Model 4
L.lnGHGemission	0.823***	0.833***	0.827***	0.809***
	(0.0388)	(0.0396)	(0.0392)	(0.0471)
L.Environmentaltax	0.000406	0.000141	0.000379	0.000926
	(0.000996)	(0.00101)	(0.000950)	(0.000770)
L.RDspending	-0.00269***	0.000787		-0.00152**
	(0.000975)	(0.00149)		(0.000735)
L.TechnologyDiffusion	-0.00270**	-0.00206*	-0.00297**	-0.00124
	(0.00102)	(0.00113)	(0.00112)	(0.00115)
L.Renewableenergyconsumption	-0.00352***	-0.00341***	-0.00383***	-0.00389***
	(0.00108)	(0.00117)	(0.00126)	(0.00131)
L.UrbanPopulation	-0.000373	-0.000977	-0.00115	-0.000424
	(0.00104)	(0.000992)	(0.000865)	(0.000979)
L.Economicgrowth	-0.00121	-0.00119	-0.00123	-0.00201*
	(0.000880)	(0.000845)	(0.000864)	(0.00113)
L.ManufacturGDP	0.00239	0.00142	0.00216	0.00230
	(0.00168)	(0.00159)	(0.00161)	(0.00195)
RnDTechDiff	0.000537*			0.000171*
	(0.000282)			(9.33e-05)
TaxTechDiff	-5.90e-05		2.66e-06	-0.000121
	(0.000139)		(0.000128)	(0.000160)
DummyEnviT	-0.0184*	-0.0170*	-0.0157	-0.0181*
	(0.0106)	(0.00896)	(0.0104)	(0.0105)
DummyRDspend	-0.00888	-0.0179**		-0.00898
	(0.00837)	(0.00765)		(0.0129)
L.NewRDwithEnergy			-0.00187**	
			(0.000701)	
NewRnDTechDiff			0.000288*	
			(0.000162)	
DummyNewRDspend			-0.0127	
			(0.00844)	
L.EPS				-0.00396
				(0.00423)
Constant	2.173***	2.119***	2.198***	2.386***
	(0.417)	(0.430)	(0.433)	(0.524)
Observations	598	602	598	482
R-squared	0.820	0.820	0.819	0.806
Number of cntryID	32	32	32	29

Robust standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Appendix C

Original Law in Norwegian from Lovdata:
Lov om avgift på CO2 i petroleumsvirksomheten på kontinentalsokkelen:

§ 1.For så vidt Stortinget vedtar at det til statskassen skal betales CO_2-avgift på brenning av petroleum og utslipp av naturgass i forbindelse med petroleumsvirksomhet på kontinentalsokkelen, gjelder reglene i denne lov når ikke annet er særskilt fastsatt i Stortingets vedtak om avgiften.

§ 2.CO_2 -avgift beregnes av petroleum som brennes og naturgass som slippes ut til luft samt av CO_2 som utskilles fra petroleum og slippes ut til luft, på innretning som nyttes i forbindelse med utvinning eller transport av petroleum

a) i indre norsk farvann, på norsk sjøterritorium og på kontinentalsokkelen, jf. petroleumsloven § 1-6 bokstav l),
b) i tilstøtende havområder utenfor kontinentalsokkelen i den utstrekning utvinning av petroleum er forbeholdt Norge etter avtale med annen stat,
c) i havområder utenfor kontinentalsokkelen for så vidt gjelder norsk anlegg for transport av petroleum,
d) i riket for så vidt gjelder anlegg som omfattes av petroleumsskatteloven § 3 b) tredje punktum.

Når utvinning skjer fra petroleumsforekomst som strekker seg over midtlinjen i forhold til annen stat, jf bokstav b), beregnes CO_2-avgift bare av de mengder som svarer til de norske rettighetshavernes eierandeler i vedkommende innretning.

Appendix D

The constructed dataset in its entirety, with additional variables not included in any model.

Countries:

Australia
Austria
Belgium
Canada
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Japan
Korea
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom
United Stats

Additional variables in dataset:

New R&D with Energy R&D
Forest area
Population Growth
GDP per capita

cntryname	cntryID	year	GHG emi	Environ tax	R&Dspend	Techno Diff	Renew. E. Con	Urbanization	Eco Growth	EPS	Urban Pop	Manuf GDP	New R&D	Forest	GDP p.c	Pop. Growth
Australia	101	1990	414973,7	0	3,115044043	5,89643295	8,009578595	1,47997249	3,529128957	.	85,4	15,03323857	5,651258767	16,7	18221,10499	1,479978016
Australia	101	1991	416477,89	0	3,412538478	6,306794247	8,245472298	1,27458032	-0,425953257	.	85,4	13,74943784	5,710000734	16,7	18840,64044	1,274577578
Australia	101	1992	420764,25	0	3,175035041	6,384723524	7,516470192	1,4075835	0,404054753	.	85,566	13,80638488	5,276440882	16,7	18594,64928	1,213390775
Australia	101	1993	422801,08	0	3,092466441	6,813467369	8,6169922	1,19080904	4,015611298	0,8125	85,748	14,00637935	5,175414153	16,7	17661,65887	0,978336681
Australia	101	1994	423232,13	8,43786621	3,322541102	6,776581128	8,259947233	1,2682047	4,044728123	0,8125	85,928	14,37348966	5,343443561	16,7	18083,1385	1,058508842
Australia	101	1995	436863,96	9,11148643	1,194282154	6,647889498	8,217805615	1,41495627	3,881199695	0,8125	86,106	14,40332019	3,997155613	16,7	20364,2497	1,208019812
Australia	101	1996	443213,16	8,64456272	1,163941869	6,005648372	8,865971218	1,51917013	3,947285625	0,78125	86,283	13,9790744	4,014176643	16,7	21921,7799	1,313819299
Australia	101	1997	455692,63	9,75492001	1,114991124	6,09932777	9,080243546	1,37453493	3,943476006	0,78125	86,504	13,50297253	4,165638952	16,7	23526,28664	1,11872569
Australia	101	1998	470580,22	9,68865013	2,502570366	5,879077772	8,595072717	1,29969374	4,430865185	0,6875	86,727	13,64639905	3,805069294	16,7	21341,72965	1,042235716
Australia	101	1999	479616,71	9,12254238	2,448869684	5,734362401	8,507273551	1,39585203	5,004256233	0,6875	86,947	13,04069085	3,72935791	16,7	20537,47184	1,142505187
Australia	101	2000	489812,92	7,91461325	2,950046257	5,644046289	8,423342353	1,44268462	3,872015071	0,65625	87,165	12,60708064	4,538367594	16,7	21666,95168	1,192272323
Australia	101	2001	502347,13	8,11470318	2,938152123	5,762682418	8,370282463	1,59242627	1,92866859	0,7375	87,378	12,07978367	4,407291654	16,7	19496,63871	1,348358342
Australia	101	2002	503584,93	7,83385086	2,903966883	6,076345116	8,738721176	1,40693621	3,863095587	0,8625	87,541	11,53690554	4,426442381	16,7	20062,22114	1,220563785
Australia	101	2003	506235,37	7,55333042	3,484704012	6,524728025	7,139003211	1,40975994	3,079248901	0,8625	87,695	11,91524841	5,016143619	16,7	23445,18676	1,233996663
Australia	101	2004	519037,24	7,72835112	3,456337651	6,754306437	6,668828099	1,33480908	4,156584913	0,83125	87,849	11,94484646	5,268334023	16,7	30449,61965	1,159352162
Australia	101	2005	523479,26	7,34851742	1,824740007	6,816941382	6,695245105	1,49152573	3,216467335	0,83125	88	11,27596404	3,486814901	16,7	33995,85167	1,319789554
Australia	101	2006	529885,15	6,6646142	2,318335132	7,246127367	6,84431057	1,6455382	2,990667578	0,975	88,15	10,77018041	4,265588312	16,7	36100,55852	1,475227945
Australia	101	2007	537930,78	6,54143572	2,838528602	8,697441929	6,939096681	0,79243111	3,760144101	0,975	88,298	10,10418579	5,243504475	16,7	40976,45219	0,624678435
Australia	101	2008	544573,76	6,68734169	2,742528857	10,15700096	6,790637679	2,17036667	3,702292955	1,1625	88,445	9,990400382	6,797672629	16,7	49650,41754	2,00402174
Australia	101	2009	541177,63	7,12239647	4,070473172	10,80177414	6,794859973	2,22485411	1,731817915	1,8125	88,59	9,074581027	9,62705689	16,7	42702,19828	2,06104513
Australia	101	2010	540210,87	6,9086833	3,750739487	11,76320164	7,159707789	1,71677877	1,962366101	1,6125	88,733	8,638932397	8,629397344	16,7	51801,04895	1,555489589
Australia	101	2011	541542,76	6,65329742	3,318442009	10,41532045	7,477579186	1,549427	2,321478902	2,425	88,875	7,95968435	7,679072496	16,7	62133,61078	1,389527316
Australia	101	2012	543648,45	0	3,87315174	9,102767695	8,442666147	1,88029608	3,727818428	2,775	89,015	7,584889473	8,13080805	16,7	67511,82496	1,722895219
Austria	102	1990	78086,35	0	1,898008944	6,560101677	25,26325878	0,8228499	4,345625519	1,125	65,765	22,10726822	2,460433585	46,7	21628,75363	0,762001611
Austria	102	1991	82135,09	0	2,419033555	7,071569271	24,62211069	1,05161934	3,44163932	1,125	65,8	21,64527528	3,249050355	46,7	22356,92109	0,998418103
Austria	102	1992	75410,77	0	2,175130567	7,364284675	26,24648125	1,100567	2,093511097	1,125	65,8	20,85162483	2,838203853	46,7	24820,22854	1,100552287
Austria	102	1993	75484,12	0	3,17955621	7,062064965	26,45604552	0,82462802	0,526820378	1,1875	65,8	19,68238348	3,937701021	46,7	24023,51502	0,824627941
Austria	102	1994	76345,45	4,54759979	2,891978811	7,166773527	25,7487398	0,38486702	2,402145183	1,1875	65,8	19,55314501	3,815907918	46,7	25584,91877	0,384869547
Austria	102	1995	79743,56	5,16437483	2,461768027	6,827723863	25,7331252	0,1531009	2,667963818	1,53125	65,8	19,9548486	2,920323268	46,7	30252,79469	0,153106261
Austria	102	1996	82754,78	5,01708221	2,21122186	6,469290918	24,13979661	0,13501483	2,39832722	1,53125	65,8	19,76077676	2,614161874	46,7	29742,43697	0,135019834
Austria	102	1997	82277,81	5,59834814	2,102416898	6,348293057	24,96232361	0,11332058	2,205029391	2,21875	65,8	20,11143155	2,995329016	46,7	26646,88677	0,113316608
Austria	102	1998	81653,02	5,42040443	1,669064508	5,970501475	24,49393457	0,10972486	3,559932645	2,53125	65,8	19,97867553	2,249618283	46,7	27289,6321	0,109728368
Austria	102	1999	79966,28	5,47480679	1,543130803	6,317697922	26,51239601	0,19456259	3,590018703	2,21875	65,8	20,21869852	2,242953468	46,7	27116,67208	0,194563153
Austria	102	2000	80276,96	5,85029411	1,529006031	6,415792721	26,46581452	0,24046218	3,368389487	2,375	65,8	20,51927535	2,072382726	46,7	24517,26515	0,240466652
Austria	102	2001	84274,66	6,12484455	1,379396072	6,37783232	25,56095051	0,38432316	1,350512043	2,5125	65,801	20,65373665	2,087298257	46,7	24489,73776	0,382799394
Austria	102	2002	85975,57	6,40649748	1,304867712	6,432428488	24,67461891	0,49959002	1,655867072	2,5125	65,806	19,95567409	1,996905008	46,7	26351,3815	0,491980464

Austria	102	2003	91984,6	6,5970788	1,663437528	6,610175846	22,56999759	0,49624589	0,756148722	2,71875	65,812	19,63797868	2,368300682	46,7	32102,92638	0,487133895
Austria	102	2004	91569,35	6,57014275	1,375516366	6,936102608	23,20222047	0,62953558	2,705728356	2,65625	65,818	19,55011055	2,102799355	46,7	36693,39958	0,620413127
Austria	102	2005	92580,94	6,54130888	1,607823501	7,116073661	24,31056124	0,69037213	2,140718091	3,01875	65,824	19,69028807	2,460714217	46,7	38242,05007	0,681267248
Austria	102	2006	89710,79	6,239645	1,626404901	8,035506809	26,63306808	0,50240228	3,350825444	3,175	65,829	20,06967508	2,306959528	46,7	40430,99361	0,494797775
Austria	102	2007	86967,42	6,06754494	1,622243032	8,62882193	29,05505684	0,33325728	3,621477457	2,95625	65,835	20,45199484	2,6622076	46,7	46586,6486	0,324146535
Austria	102	2008	86882,03	5,90043688	1,629618823	10,13480478	29,636204	0,32214896	1,547294053	3,43125	65,841	19,59504764	2,540221279	46,7	51386,37841	0,313041438
Austria	102	2009	80147,97	5,96880913	1,874086046	10,37799909	31,31491199	0,27107084	-3,799099689	3,825	65,847	18,46207368	3,071396053	46,7	47654,19387	0,26195319
Austria	102	2010	84807,85	5,93417501	1,769928235	13,09788654	31,39805136	0,24798907	1,880117659	3,825	65,852	18,67364204	2,965367861	46,7	46593,38922	0,2403943
Austria	102	2011	82760,84	6,10688686	2,008905838	14,28571429	31,45927804	0,34618371	3,071425817	3,575	65,858	18,76670739	3,370655462	46,7	51130,96905	0,337080842
Austria	102	2012	80059,36	5,938241	2,35858474	16,07594937	34,45059921	0,46504713	0,883846197	3,475	65,864	18,93466508	4,279717474	46,7	48348,22596	0,455937472
Belgium	103	1990	142952,13	0	1,03286345	5,166846071	1,272395725	0,38647345	3,137407794	.	96,377	.	4,5758097	22,5	20678,85194	0,298235706
Belgium	103	1991	144950,64	0	3,008187896	6,8359375	1,214779085	0,45870897	1,833065354	0,625	96,461	.	6,507035606	22,5	21121,81831	0,371593166
Belgium	103	1992	143694,93	0	1,915254946	6,198347107	1,187536089	0,48964801	1,530640742	0,65625	96,542	.	5,317704887	22,5	23461,66786	0,405713496
Belgium	103	1993	142765,54	0	1,747241903	5,442176871	0,954090854	0,47346973	-0,96185258	0,71875	96,622	.	4,918702804	22,5	22368,8285	0,390638518
Belgium	103	1994	148485,04	5,65386486	1,754474907	7,512195122	0,939572845	0,38889489	3,226987658	0,71875	96,7	.	5,06759237	22,5	24300,7853	0,308197074
Belgium	103	1995	150326,89	5,63908863	1,746743987	5,72597137	1,25915265	0,28903817	2,384741693	0,71875	96,777	20,43448673	4,851672653	22,5	28522,07455	0,209436838
Belgium	103	1996	154307,66	6,1288929	2,542447414	7,90842872	1,182862424	0,27182921	1,551167004	0,71875	96,851	20,3022979	5,407447365	22,5	27646,04854	0,195393176
Belgium	103	1997	145679,42	6,0687108	2,457412084	6,263982103	1,146136409	0,31733291	3,743382568	0,71875	96,924	20,6118781	5,641634551	22,5	24957,55752	0,241991885
Belgium	103	1998	151211,31	5,82765245	1,939264046	9,693251534	1,292018111	0,28778775	2,006287901	0,71875	96,996	20,35671966	4,712758047	22,5	25465,25326	0,213527651
Belgium	103	1999	144947,2	5,81460047	2,629114365	7,518796992	1,39790263	0,30030113	3,716030155	0,71875	97,065	19,48950918	5,237831464	22,5	25391,73533	0,229189103
Belgium	103	2000	145856,88	5,43459892	3,309437506	7,093184979	1,447580857	0,30739685	3,550426348	0,8125	97,128	19,55928482	6,046339876	22,5	23151,95374	0,242517956
Belgium	103	2001	145182,68	5,45464182	2,643751428	6,542056075	1,592913854	0,40158954	0,924198231	0,8125	97,184	18,96194033	5,377225908	22,5	23078,41806	0,343951158
Belgium	103	2002	144717,56	5,30933809	2,678089879	5,782792666	1,691112461	0,50485038	1,559543427	0,89375	97,239	18,71155071	5,306772084	22,5	25006,79135	0,448268895
Belgium	103	2003	145316,45	5,45762062	2,091462935	6,627393225	1,861079432	0,47312646	0,889780595	0,8625	97,292	17,93682751	4,182409636	22,5	30702,51349	0,418641508
Belgium	103	2004	146397,6	5,97777128	1,607614277	7,881773399	2,033589224	0,4872536	3,434787675	1,675	97,345	17,89405491	3,651769901	22,5	35547,53586	0,432788248
Belgium	103	2005	142063,28	5,96285105	2,302912823	7,911392405	2,463248349	0,60346178	1,893853556	2,0375	97,397	17,64089122	4,209786839	22,5	36927,99908	0,550055708
Belgium	103	2006	138341,86	5,45865726	2,151167748	6,196213425	2,858684599	0,71190251	2,630146232	2,00625	97,448	17,00259744	4,058114141	22,5	38936,33091	0,659558215
Belgium	103	2007	133440,16	5,3260951	2,527710127	10,23339318	3,188286956	0,78460512	3,000341023	1,80625	97,497	16,89797376	4,391977715	22,5	44449,68906	0,734330831
Belgium	103	2008	135823,29	5,05702972	2,051578587	7,952622673	3,64476892	0,84021705	0,953468801	1,90625	97,546	15,8670574	3,599875111	22,5	48561,3564	0,789976845
Belgium	103	2009	123208,52	5,33081579	2,524225404	9,136212625	4,79645852	0,85379395	-2,618664789	2,05	97,594	14,28393198	4,276113859	22,5	44999,20158	0,804599573
Belgium	103	2010	130610,94	5,37642813	2,384606117	9,328968903	5,187560073	1,18810465	2,501054567	2,16875	97,641	14,72097852	4,002831981	22,5	44360,90169	1,139951926
Belgium	103	2011	120145,51	5,36325836	2,284992275	9,8546042	5,461707355	1,20763777	1,618317967	2,11875	97,687	14,25050936	4,110574049	22,5	47801,5969	1,160536579
Belgium	103	2012	116520,32	4,98861551	2,292677809	6,464646465	7,384542226	0,77208009	0,092812881	2,06875	97,732	14,08064712	4,471578068	22,5	44818,04505	0,726031655
Canada	104	1990	590908,11	0	1,705995546	5,910686025	20,56563987	1,51971401	0,128983847	0,71875	76,582	.	7,010975785	38,2	21302,39691	1,493593109
Canada	104	1991	583211,91	0	1,775650331	6,188973455	20,77956671	1,41011326	-2,120244834	0,71875	76,62	.	8,986577016	38,2	21591,13916	1,360506174
Canada	104	1992	600162,23	0	2,078563058	6,166387145	20,65564093	1,57528573	0,854369659	0,78125	76,887	.	8,97941105	38,2	20692,72203	1,2274176
Canada	104	1993	602008,18	0	2,278325922	6,517651974	20,44558172	1,43839673	2,607371167	0,8125	77,152	.	9,195404307	38,2	19936,37706	1,094331921

Canada	104	1994	622358,35	4,67003345	2,358980357	6,406382207	20,32336842	1,30026136	4,554009301	0,8125	77,414	.	9,374356448	38,2	19785,67904	0,961244717
Canada	104	1995	639072,03	4,72395468	3,730067156	5,961111738	20,39954549	1,16474223	2,738496065	0,8125	77,675	.	9,508411919	38,2	20509,00309	0,828159179
Canada	104	1996	661055,11	4,61768484	3,203097404	5,974062292	20,43916418	1,43186037	1,679609298	0,78125	77,951	.	10,85871036	38,2	21129,43543	1,077164681
Canada	104	1997	675981,97	4,45223093	3,722199073	5,784570011	20,3248215	1,55480276	4,25334289	1,34375	78,34	.	9,759408086	38,2	21709,29634	1,057015395
Canada	104	1998	683279,18	4,34956074	3,713571906	5,79640795	20,25379494	1,35459019	4,138185477	1,34375	78,724	.	8,535108472	38,2	20875,24831	0,865613663
Canada	104	1999	696158,27	3,99779058	3,972768611	6,225240521	20,68693034	1,30764136	4,997255522	1,34375	79,103	.	8,494152393	38,2	22109,60399	0,827369318
Canada	104	2000	721362,48	3,79494071	4,526083083	6,250589827	20,52057544	1,35594394	5,123124976	1,34375	79,478	.	8,98118272	38,2	24031,9512	0,882998577
Canada	104	2001	713949,96	3,84588432	4,448531599	7,163814987	20,01707509	1,42637638	1,6883736	1,34375	79,81	.	10,04755669	38,2	23573,75007	1,009521666
Canada	104	2002	719623,39	4,00322247	4,603236796	7,750759878	20,70161688	0,99481899	2,801865677	1,59375	79,888	.	8,826535351	38,2	23995,01633	0,897131277
Canada	104	2003	740178,7	4,08820677	4,822434936	7,437321218	20,28456477	1,09507088	1,925321407	2,28125	79,967	.	11,1095747	38,2	28026,00601	0,996232739
Canada	104	2004	743568,33	3,85967612	4,419310488	7,819897025	20,45335502	1,09952778	3,138786775	2,28125	80,045	.	9,417332486	38,2	31830,01187	1,002034424
Canada	104	2005	735829,05	3,70130038	4,875381265	8,197000102	21,50594153	1,08205383	3,163130123	2,25	80,122	.	8,911850492	38,2	36028,23249	0,985903767
Canada	104	2006	727849,65	3,60788202	4,36507493	8,974132135	21,22869354	0,91035488	2,621779104	2,5625	80,213	.	9,511780504	38,2	40243,55228	0,796844597
Canada	104	2007	749288,91	3,55106044	4,384915189	10,1886209	21,20780985	1,19773854	2,008315698	3,0625	80,396	12,69591707	9,786772202	38,2	44328,47538	0,969853611
Canada	104	2008	731080,7	3,60029721	4,309197246	11,44203985	21,40806895	1,30831924	1,17542339	3,28125	80,578	11,27375161	10,27263848	38,2	46400,44185	1,082197086
Canada	104	2009	689313,24	3,81057048	4,249013715	11,88692255	21,36638808	1,36797561	-2,711467282	3,875	80,758	10,73430796	11,24505138	38,2	40764,14135	1,144840183
Canada	104	2010	699302,26	3,85662723	4,123214067	12,12315001	20,65609729	1,33536705	3,374248555	3,3125	80,937	10,67505059	13,65392204	38,2	47463,63119	1,113959721
Canada	104	2011	701212,37	3,77856374	4,513712291	12,2717049	20,69118057	1,20729899	2,96010266	3,6125	81,115	.	12,87396966	38,2	52086,53352	0,987617711
Canada	104	2012	698626,47	3,68939567	3,85852514	11,65121997	20,59872178	1,41038595	1,922864994	3,3625	81,293	.	11,34737829	38,2	52733,47369	1,19118433
Czech Republ	105	1990	196145,7	0	0	.	2,862288192	-0,3063714	.	.	75,22	.	0	34	3901,525394	-0,267830773
Czech Republ	105	1991	182192,75	0	0	.	2,562023835	-0,3225292	-11,61494453	.	75,158	.	0	34	2867,229413	-0,240064842
Czech Republ	105	1992	165624,18	0	0	.	4,243524326	-0,0682111	-0,506541936	.	75,03	.	0	34	3338,654991	0,102241165
Czech Republ	105	1993	159466,81	0	0	10,57567917	4,279165541	-0,0681284	0,061903461	.	74,901	23,42872576	0	34	3916,051586	0,103947042
Czech Republ	105	1994	149435,24	7,55308962	0	8,37182448	4,93832704	-0,1362538	2,909311107	.	74,772	23,54824589	0	34	4583,584634	0,036121766
Czech Republ	105	1995	151773,53	7,79937029	0	7,968452543	4,363284735	-0,2339977	6,221404708	.	74,643	23,71894604	0	34	5765,048439	-0,061314063
Czech Republ	105	1996	155539,54	7,563972	0	7,767722474	4,385888864	-0,2906834	4,282800971	.	74,513	24,82754436	0	34	6473,435452	-0,116381299
Czech Republ	105	1997	151816,23	7,15205479	0	7,254138267	4,609866712	-0,2837282	-0,674269941	.	74,382	25,84571586	0	34	5980,258304	-0,107762749
Czech Republ	105	1998	144667,47	7,33854723	0	6,414762742	5,060405787	-0,2710202	-0,316035916	.	74,251	25,31081885	0	34	6447,463539	-0,094744752
Czech Republ	105	1999	137106,75	7,69477129	0	6,201911868	5,434782179	-0,2787621	1,438052945	.	74,12	25,1149991	0	34	6293,304387	-0,102175934
Czech Republ	105	2000	146330,13	7,47779989	3,260354037	8,062880325	4,839103489	-0,4586622	4,294134332	.	73,988	25,9129217	4,948144102	34	5994,528277	-0,280414108
Czech Republ	105	2001	146326,41	7,61849928	3,641820402	9,077336518	5,293217568	-0,5258602	3,051521405	.	73,877	26,15516546	5,46903783	34	6594,717465	-0,375719704
Czech Republ	105	2002	142844,95	7,2280488	4,028219716	9,73967684	5,756477055	-0,2849817	1,646950568	.	73,809	24,56819567	5,874827537	34	8011,898074	-0,192901618
Czech Republ	105	2003	145827,26	7,31307411	4,160285301	9,845788849	5,572770828	-0,1221541	3,601843373	2,25	73,74	24,0438493	5,939699007	34	9741,058384	-0,028620591
Czech Republ	105	2004	147274,23	7,49512434	4,175749683	9,543568465	6,090694297	-0,063183	4,947454577	2,28125	73,671	25,38709047	6,303188323	34	11667,63212	0,030434848
Czech Republ	105	2005	145965,05	7,65579748	3,138477721	12,02898551	6,391730647	0,04462347	6,442262581	3,2375	73,602	25,49664125	5,61665867	34	13317,72983	0,13832598
Czech Republ	105	2006	147021,15	7,46320248	2,7190205	11,06442577	6,827250411	0,17700669	6,876544673	3,2375	73,533	25,92572632	5,268593853	34	15159,14115	0,270795629
Czech Republ	105	2007	147245,85	7,52305555	2,401022024	11,46496815	7,675563844	0,48830151	5,529266605	2,9875	73,463	25,96111547	5,087958265	34	18333,9459	0,583542205

Czech Republ	105	2008	142184,64	7,57591343	2,832052934	8,725761773	7,857030689	0,73545003	2,710956215	2,93125	73,394	24,53406297	5,847308446	34	22649,37934	0,829412603
Czech Republ	105	2009	134205,66	7,93008327	2,586726165	10,3960396	8,710845761	0,47430687	-4,841786335	3,075	73,324	22,8686931	5,981801611	34	19698,49209	0,569729451
Czech Republ	105	2010	137007,81	7,88147688	2,742919372	10,33653846	9,49242779	0,19720909	2,295089115	3,075	73,255	23,44897343	6,415287567	34	19763,9638	0,291361674
Czech Republ	105	2011	135276,54	8,25384331	2,258226288	9,913258984	10,23692669	0,11114592	1,963780536	.	73,185	24,4665344	5,803844855	34	21656,39764	0,206747667
Czech Republ	105	2012	131466,12	7,99913454	1,829339063	10,37296037	10,92614	0,04422601	-0,808400773	.	73,115	24,79875164	5,23431474	34	19670,40261	0,139925656
Denmark	106	1990	70020,49	0	3,801511962	6,476484194	7,047154766	0,24028513	1,607441101	0,625	84,843	17,15016321	7,177259393	13,5	26861,79859	0,16245632
Denmark	106	1991	80532,19	0	3,227082506	7,147719537	7,075165198	0,29250621	1,30042839	1,5625	84,871	16,89297684	5,533281343	13,5	26960,97561	0,259518212
Denmark	106	1992	74462,61	0	4,538573684	7,442298634	7,750582224	0,36249195	1,975462341	1,96875	84,898	17,01167481	8,680878316	13,5	29526,16569	0,330671402
Denmark	106	1993	76641,83	0	4,60354859	7,170111288	7,705352182	0,36494997	-0,089601054	2,0625	84,925	16,49335797	8,758520054	13,5	27553,12351	0,333166396
Denmark	106	1994	80590,54	8,49140549	4,213557625	7,494935854	7,335806032	0,36950179	5,525396767	2,0625	84,952	16,75823768	6,419974959	13,5	29992,22227	0,337707376
Denmark	106	1995	77280,44	9,05688381	4,37503388	7,608877023	7,522789088	0,55273961	3,065170464	1,8125	84,979	16,99856247	6,629535111	13,5	35351,38071	0,520962181
Denmark	106	1996	90235,74	9,52138519	4,373977788	6,789806738	7,270427759	0,59770184	2,900137321	1,8125	85,006	16,47040608	6,701502271	13,5	35650,72434	0,565926342
Denmark	106	1997	80739,74	9,61140919	2,860189182	6,873806631	8,11695722	0,4473065	3,260892522	1,8125	85,033	17,03500614	5,500067408	13,5	32835,92877	0,415564969
Denmark	106	1998	76937,81	10,3722525	3,657866488	6,858262573	8,526222107	0,39492576	2,218139149	2,3125	85,06	17,04861094	5,680231839	13,5	33368,15485	0,363162524
Denmark	106	1999	74271	10,3999395	3,145061677	6,939558682	9,076982851	0,36144344	2,948015396	2,125	85,086	16,70885216	5,044406636	13,5	33440,80162	0,330886246
Denmark	106	2000	69954,8	9,7636795	2,65378627	6,8046044	10,74562949	0,35067918	3,746892574	2,3125	85,1	16,41905552	4,445248949	13,5	30743,55917	0,334233619
Denmark	106	2001	71548,51	9,86398315	2,365640051	6,524317912	11,13050512	0,41706362	0,82315273	2,4125	85,15	16,29938753	4,27403881	13,5	30751,64946	0,358315679
Denmark	106	2002	70932,84	10,2674704	2,323052582	8,2791587	11,87186695	0,43684812	0,466302594	2,56875	85,25	16,21774868	4,601896577	13,5	33228,69291	0,319487125
Denmark	106	2003	75837,35	9,92185879	1,874814615	7,916666667	12,72527312	0,40096413	0,39009173	2,69375	85,36	15,38973187	4,192792114	13,5	40458,77064	0,272010444
Denmark	106	2004	69889,78	10,0708771	1,924565884	8,90596745	14,4559935	0,4994684	2,638949775	3,19375	85,566	14,87762506	4,679383516	13,5	46487,51491	0,258432282
Denmark	106	2005	65588,79	9,80914783	1,732533272	8,718330849	16,13967881	0,61384154	2,437027555	3,675	85,856	14,4226055	4,686738866	13,5	48816,83586	0,275481733
Denmark	106	2006	73469,67	9,88842869	1,682936034	10,26400862	15,28531383	0,6100965	3,796740952	3,7	86,098	14,45343141	4,932979282	13,5	52041,00297	0,328645159
Denmark	106	2007	68920,42	9,71429157	1,924492102	11,6875	17,7163367	0,6697121	0,824418073	3,45	86,293	14,41034598	5,918489473	13,5	58501,13832	0,443466054
Denmark	106	2008	65404,39	9,11643314	2,49412824	13,01874163	18,56132306	0,81210433	-0,717957057	3,55	86,487	13,77787898	7,278829701	13,5	64181,99467	0,58754759
Denmark	106	2009	62511,41	8,44746685	2,646451673	14,98864497	19,34925559	0,72799077	-5,087934006	4,7125	86,654	12,97870295	6,642537593	13,5	57895,50122	0,535079062
Denmark	106	2010	63006,53	8,63667583	2,09193949	15,32221721	21,28445876	0,60676605	1,625135885	4,675	86,795	12,64136073	8,166927521	13,5	57647,66876	0,444197155
Denmark	106	2011	58051,67	8,74704742	2,06327698	23,05810398	23,95230713	0,59821406	1,152136945	4,64375	86,957	12,76662794	7,665529785	13,5	61304,0612	0,411737855
Denmark	106	2012	53118,01	8,23295879	1,909000661	22,1822542	27,56360072	0,58880788	-0,65522463	4,54375	87,142	12,96999122	6,433229648	13,5	57636,12531	0,376272243
Estonia	107	1990	40614,54	0	0	.	3,3560787	-0,1915429	.	.	71,231	.	0	53	.	0,066490191
Estonia	107	1991	37439,42	0	0	.	3,52622145	-0,7621987	.	.	71,046	.	0	53	.	-0,502159185
Estonia	107	1992	27385,1	0	0	.	5,906590568	-2,0863401	.	.	70,86	.	0	53	.	-1,824181555
Estonia	107	1993	21251,03	0	0	.	6,70518744	-2,8371306	.	.	70,674	.	0	53	.	-2,574319978
Estonia	107	1994	21900,65	0	0	.	9,268725691	-2,4035559	.	.	70,487	.	0	53	.	-2,138588635
Estonia	107	1995	20064,37	2,08455038	0	6,818181818	12,30589952	-2,0509961	.	.	70,3	19,7732258	0	53	3036,427135	-1,785399536
Estonia	107	1996	20726,23	3,66457343	0	4,750593824	19,53619571	-1,744615	5,890099988	.	70,111	18,67838306	0	53	3347,879316	-1,475364638
Estonia	107	1997	20331,52	4,01814318	0	7,393715342	19,7310713	-1,4094001	11,73534514	.	69,923	19,18284555	0	53	3614,897042	-1,14091924
Estonia	107	1998	18811,16	5,19938707	0	4,296296296	17,73795007	-1,2326877	6,810492552	.	69,733	16,8074313	0	53	4045,695644	-0,960559005

Estonia	107	1999	17450,52	4,6969161	0	4,636785162	20,06404662	-0,6729551	-0,271504381	.	69,543	16,15221104	0	53	4139,654364	-0,400177491
Estonia	107	2000	17156,96	4,73908567	0	3,289473684	19,83414246	0,92640771	9,696269714	.	69,368	17,29766694	0	53	4069,853821	1,178366929
Estonia	107	2001	17542,39	6,28257227	0	2,692307692	18,93654751	-0,8187713	6,15810782	.	69,242	17,98213638	0	53	4490,65903	-0,636963124
Estonia	107	2002	16935,3	5,7685318	5,090029904	5,050505051	19,4153559	-0,8155653	6,122039342	.	69,116	17,71160079	8,773939047	53	5298,623213	-0,633433796
Estonia	107	2003	18810,48	5,91606712	4,405312375	4,87804878	19,82991539	-0,8115904	7,48005652	.	68,989	17,69485594	9,480479194	53	7165,689909	-0,627622448
Estonia	107	2004	19129,07	6,80916357	4,554710834	16,66666667	19,98714532	-0,7820946	6,478126747	.	68,862	16,93481963	8,556491037	53	8849,319109	-0,59782051
Estonia	107	2005	18421,21	7,33765268	5,423664884	21,05263158	18,8612355	-0,75679	9,471125802	.	68,735	16,64173193	7,584699696	53	10336,38955	-0,572255525
Estonia	107	2006	17837,32	7,04545546	5,795343014	11,32075472	17,163079	-0,7760881	10,4127813	.	68,607	16,47166783	8,844999845	53	12591,95899	-0,58965556
Estonia	107	2007	20948,75	6,87539768	7,486631016	16,66666667	18,56525678	-0,6429675	7,900134323	.	68,479	15,92750419	10,84239014	53	16580,99704	-0,456188535
Estonia	107	2008	19545,92	7,09972525	5,446779339	12,72727273	20,18899854	-0,4552415	-5,327658052	.	68,351	15,47860068	8,652411211	53	18087,67866	-0,26813372
Estonia	107	2009	16188,5	8,06934357	4,41022013	7,792207792	24,08876337	-0,3801886	-14,73756319	.	68,223	14,12665286	7,514589321	53	14718,33959	-0,192768077
Estonia	107	2010	19892,34	8,50773907	10,45603337	21,05263158	25,12988366	-0,4172586	2,475873851	.	68,094	15,68612984	13,55076377	53	14632,08221	-0,228057969
Estonia	107	2011	20483,96	8,3509407	6,687537468	14,60674157	24,98354122	-0,4932428	8,263792513	4,59375	67,965	16,57269682	8,955988144	53	17177,4803	-0,303582824
Estonia	107	2012	19188,43	8,32192326	3,622558931	21,42857143	24,90855152	-0,549393	4,650562696	.	67,835	16,0921482	5,66951649	53	17132,22729	-0,357944411
Finland	108	1990	70328,96	0	1,436610507	4,983606557	24,62762487	1,29878198	0,675734	0,53125	79,367	22,43943149	5,602382253	72	28380,54891	0,443382074
Finland	108	1991	68141,96	0	2,683686161	5,958721704	24,12924633	1,1441077	-5,914427823	0,9375	79,843	19,70816426	6,318041848	72	25503,21521	0,546172018
Finland	108	1992	66720,51	0	3,088149356	6,187076698	25,22908745	0,91822685	-3,324588534	0,9375	80,128	20,74464491	7,041626789	72	22337,48712	0,561909851
Finland	108	1993	68814,65	0	3,005995724	6,931512518	26,10416409	0,83392913	-0,734496683	2	80,409	22,67349579	6,882280365	72	17617,03044	0,483854089
Finland	108	1994	74204,2	5,9383316	2,388846824	5,973295854	25,24888808	0,77743026	3,939266917	1,96875	80,688	23,97850004	5,871679465	72	20305,58355	0,431048903
Finland	108	1995	70767,9	6,45603657	2,54337694	6,728971963	27,40241176	0,72189758	4,207099134	1,96875	80,963	25,37289235	6,064806699	72	26273,4659	0,381655333
Finland	108	1996	76491,71	6,64915895	2,563825612	5,624629959	27,01264723	0,64865989	3,658833584	1,96875	81,223	24,49114622	5,876402221	72	25777,6413	0,328037914
Finland	108	1997	75111,84	7,23328781	2,299917309	4,297224709	28,96927842	0,59610575	6,251772747	2,46875	81,466	24,98230346	6,358572647	72	24676,49708	0,29737733
Finland	108	1998	71531,01	7,19957399	2,234125926	4,692891649	30,67659242	0,56087397	5,428579929	2,21875	81,707	26,36727519	8,636561925	72	25989,4075	0,265472962
Finland	108	1999	70985,09	7,48973703	2,193323928	4,263093788	30,36570591	0,52418098	4,444127515	2,21875	81,946	26,23353104	8,408082505	72	26178,79178	0,232116249
Finland	108	2000	69188,4	6,66408205	2,268632482	3,369565217	31,56329564	0,4964153	5,634840543	2,0625	82,183	27,64345638	7,679873509	72	24253,25042	0,207606515
Finland	108	2001	74400,02	6,66118956	2,181273657	5,612648221	29,38273944	0,45252798	2,580758439	2,0625	82,368	26,85448152	6,465326843	72	24913,24452	0,227687342
Finland	108	2002	76624,5	6,87090349	2,200378421	4,83736447	29,57917427	0,40614696	1,680365346	2,4375	82,503	26,11501219	6,406578378	72	26834,02625	0,24238105
Finland	108	2003	84577,2	7,28713226	1,951800936	5,719313682	28,44682133	0,40197389	1,993970438	3,1875	82,638	25,18469787	6,522886603	72	32816,16088	0,23845724
Finland	108	2004	80583,77	7,48287439	1,941306732	5,781865966	31,11235198	0,45237156	3,926026618	3,1875	82,772	24,64901407	6,866814294	72	37636,11173	0,290350362
Finland	108	2005	68624,26	7,0281682	1,838729871	6,509695291	31,62415601	0,50279364	2,779967826	3,05	82,905	24,32722234	6,665524435	72	38969,17163	0,342248594
Finland	108	2006	79900,3	6,87074566	1,613268362	7,713625866	31,35267955	0,54286728	4,055186846	3,76875	83,037	25,0606413	5,999711798	72	41120,67651	0,383777136
Finland	108	2007	78248,9	6,38101816	1,634080047	8,278145695	32,09141255	0,58307355	5,184819694	3,51875	83,168	25,29605143	9,424628764	72	48288,5491	0,425429832
Finland	108	2008	70126,26	6,26087999	1,438303702	10,18329939	34,71343259	0,62292464	0,720645613	3,71875	83,299	23,70147782	10,23330571	72	53401,31487	0,465549285
Finland	108	2009	66003,04	6,15880156	1,51571561	9,894640403	32,43995752	0,63420134	-8,269018743	3,8625	83,429	19,13001743	11,41048505	72	47107,15571	0,478246393
Finland	108	2010	74397,39	6,53918934	1,500888936	10,61728395	33,51727033	0,61199807	2,992355336	3,83125	83,558	19,52573035	11,14882732	72	46205,16601	0,457494535
Finland	108	2011	66861,11	7,15971088	1,602829378	11,61356629	35,12738449	0,61900928	2,570792586	4,03125	83,688	18,86960705	11,352608	72	50787,56498	0,463558707
Finland	108	2012	60965,73	6,95348024	1,485376986	14,96212121	39,11587709	0,63221471	-1,426177315	3,93125	83,819	16,85854643	9,657654312	72	47415,55987	0,475809487

France	109	1990	560383,96	0	0,655949521	4,68225178	10,40474826	0,70899519	2,914015484	0,65625	74,056	17,69258979	3,533041816	26,5	21795,23783	0,565757638
France	109	1991	584125,17	0	0,689024066	4,780283025	11,00910523	0,31278051	1,039100304	0,65625	74,229	17,34282205	3,850012244	26,5	21782,4162	0,079445051
France	109	1992	574864,49	0	1,094549988	5,560652036	11,25496902	0,72868367	1,599669821	0,65625	74,401	16,89755283	4,97479848	26,5	23937,05692	0,497237524
France	109	1993	547997,28	0	1,270439771	5,571784824	10,827639	0,662864	-0,61264861	0,71875	74,572	16,32466782	5,181823518	26,5	22503,26085	0,433290559
France	109	1994	548585,62	4,55192232	1,371832871	6,190543802	10,93242029	0,60128417	2,345386592	0,75	74,743	16,01365569	5,471203156	26,5	23625,529	0,372238258
France	109	1995	556875,45	5,62676239	1,935546491	5,220450955	10,70050756	0,58709993	2,085086213	0,75	74,912	16,23008692	6,358038945	26,5	27037,97213	0,361248204
France	109	1996	571572,27	5,60003901	1,98607691	5,581234909	10,49529693	0,58075327	1,387998116	1,0625	75,082	15,84392998	6,639115488	26,5	27015,25896	0,354077244
France	109	1997	566289,54	5,3634758	2,077490186	5,75224178	9,986952346	0,5772493	2,337400854	1	75,25	16,04342789	6,891988492	26,5	24359,42506	0,3537435
France	109	1998	581450,75	5,40202475	2,191922994	6,132422843	9,60752997	0,59029336	3,556134289	1,0625	75,417	16,02433843	7,337786726	26,5	25101,36874	0,368612829
France	109	1999	567058,44	5,2696023	1,573316673	6,371764078	9,673697959	0,77532014	3,407102529	1,125	75,614	15,7730817	6,459995418	26,5	24799,29601	0,514446391
France	109	2000	564597,28	5,13609028	1,739838707	6,874030005	9,244493849	1,02423818	3,875158261	1,21875	75,871	15,73403728	6,551616364	26,5	22465,64184	0,684930929
France	109	2001	562987,91	4,72429085	2,835367084	6,935049583	9,32970455	1,06463788	1,954452429	1,34375	76,127	15,22462233	6,687068522	26,5	22527,31775	0,727791318
France	109	2002	557941,21	5,00550222	2,911447605	7,154697964	8,592651728	1,05901944	1,118456057	1,34375	76,38	14,7145893	6,632139323	26,5	24275,2426	0,727229885
France	109	2003	563354,03	4,82243872	3,127539491	9,101685985	8,729712437	1,03816311	0,819533268	1,34375	76,632	14,19106697	7,3779526	26,5	29691,18158	0,708775986
France	109	2004	561771,57	4,86752892	3,034736255	9,678038789	8,795727852	1,06332316	2,786420554	1,90625	76,883	13,75956441	7,72736061	26,5	33874,74255	0,736319943
France	109	2005	563576,88	4,61805248	2,61704688	10,00128883	8,571646852	1,07455731	1,607715493	2,175	77,13	13,30790455	6,920808343	26,5	34879,72633	0,753805556
France	109	2006	551867,76	4,5065794	2,780068405	10,42678583	8,854998505	1,01691848	2,374944836	2,6	77,377	12,80414322	7,323398787	26,5	36544,50853	0,697191228
France	109	2007	542720,66	4,34971714	1,840935851	12,20549738	9,587516168	0,93355451	2,361502077	2,2875	77,621	12,67949034	7,228349344	26,5	41600,58397	0,618711483
France	109	2008	537952,87	4,3470912	2,293308088	12,82636419	10,80331484	0,87142783	0,195293168	2,3125	77,864	12,09213511	7,334755374	26,5	45413,06571	0,55885743
France	109	2009	514380,38	4,49896574	2,096436481	13,52024479	11,52209746	0,82480355	-2,941338664	3,3	78,106	11,50730121	7,395320898	26,5	41631,13141	0,514486365
France	109	2010	522155,78	4,39346361	2,567281305	13,53270518	12,18258514	0,7995637	1,965657819	2,76875	78,345	11,25052888	9,260301863	26,5	40705,76623	0,494037459
France	109	2011	495981,68	4,37916899	1,50694111	14,34679647	11,30477323	0,78824183	2,079228327	2,7125	78,584	11,37492444	7,686467786	26,5	43807,4759	0,483644885
France	109	2012	496221,21	4,29356289	1,774719699	14,49983493	12,58879422	0,75366461	0,182689429	2,6125	78,82	11,32909872	7,993954067	26,5	40850,35237	0,453799463
Germany	110	1990	1248048,77	0	3,526481974	6,59037331	2,079649913	1,05636514	5,255010217	1,15625	73,118 .		9,513705081	32,5	22219,57218	0,861969449
Germany	110	1991	1201034,15	0	3,408209463	6,928096695	1,974577002	0,93490756	5,108259862	1,65625	73,269	27,41792826	8,572639922	32,5	23269,3818	0,728605547
Germany	110	1992	1150981,16	0	3,745953345	7,320741097	2,045183521	0,88447038	1,921861704	1,46875	73,36	25,89595271	8,441014449	32,5	26333,53744	0,760346947
Germany	110	1993	1141687,05	0	3,763673613	7,582564713	2,097230179	0,68601368	-0,955218405	1,53125	73,381	23,62557547	7,952337935	32,5	25488,51952	0,657391218
Germany	110	1994	1121879,99	6,50742245	3,678799206	7,601871767	2,243741303	0,29505898	2,454912964	1,4375	73,343	23,17316939	7,498046731	32,5	27087,55845	0,346856649
Germany	110	1995	1117579,85	6,32556009	3,587003741	7,35088968	2,293999825	0,21615572	1,699265564	1,375	73,286	22,76538139	7,024832733	32,5	31715,99782	0,293904444
Germany	110	1996	1136718,31	6,14404202	3,735267474	7,104191302	2,238240023	0,21576451	0,781341079	1,40625	73,232	22,20549143	7,247081213	32,5	30538,7025	0,289474899
Germany	110	1997	1100977,55	5,9595561	3,514356335	7,335777764	2,809650622	0,06161514	1,82490673	1,46875	73,17	22,367709	7,030451445	32,5	27012,17132	0,146313282
Germany	110	1998	1075180,38	5,87413406	3,445161018	7,065449372	3,028676249	-0,0750988	1,967901428	1,5	73,104	22,61109857	7,120351034	32,5	27300,30325	0,015143651
Germany	110	1999	1041303,66	6,09559536	3,447557479	7,480549882	3,245491351	0,00990451	1,98736376	1,5	73,064	22,33790199	7,085790492	32,5	26756,15168	0,064634578
Germany	110	2000	1040367,33	6,31268501	3,336838319	7,926039723	3,681457012	0,1395375	2,984908208	1,59375	73,067	22,97870825	6,759818345	32,5	23685,35075	0,1354316
Germany	110	2001	1055173,88	7,02646446	3,1083755	8,061818876	3,881177752	0,23116128	1,695286441	1,59375	73,113	22,69075551	6,226434827	32,5	23654,28277	0,168225361
Germany	110	2002	1033944,94	7,13732672	3,074264977	8,521703864	4,392483394	0,25152492	0,010756452	2,0625	73,174	22,0862374	6,080093525	32,5	25170,82421	0,168128319
Germany	110	2003	1032297,37	7,49446869	3,316189172	8,715686275	5,043176061	0,13596091	-0,720507949	2,8125	73,233	22,21295679	6,323555118	32,5	30318,51641	0,055363304

Germany	110	2004	1019806,05	7,31735134	3,458048225	8,935078787	5,81031549	0,05472984	1,18067559	2,90625	73,289	22,37889685	6,255233202	32,5	34120,19126	-0,021709728
Germany	110	2005	994459,68	7,10824537	3,445543456	9,472609641	6,752399944	0,03323612	0,706561393	3,20625	73,355	22,44864045	6,294535878	32,5	34650,77818	-0,056778262
Germany	110	2006	1002426,45	6,7787981	3,116225761	10,45204973	7,744142093	0,07651202	3,710003395	3,175	73,494	23,13498743	6,039151887	32,5	36401,42251	-0,112797498
Germany	110	2007	976583,75	6,21360731	3,152961237	11,86543865	9,389759847	0,13939992	3,269783353	2,925	73,695	23,44275126	6,693588761	32,5	41762,90891	-0,133718573
Germany	110	2008	979802,7	6,06842947	3,034721083	13,59192313	8,578436535	0,08087784	1,05210894	2,9	73,895	22,50765296	6,728684401	32,5	45632,83678	-0,190142845
Germany	110	2009	912605,83	6,25531816	2,890307279	14,27365675	9,619063151	0,01420577	-5,637953893	3,54375	74,093	19,92732087	6,932131436	32,5	41671,3027	-0,25338341
Germany	110	2010	946388,27	6,08641338	2,761436071	15,18517085	10,60449457	0,11367727	4,090769512	3,5125	74,291	22,18960716	6,598245018	32,5	41725,85007	-0,153198447
Germany	110	2011	928694,56	6,08936739	2,704479512	15,90824062	11,57817863	0,29018526	3,589997242	3,66875	74,488	22,89893488	6,521843019	32,5	45867,76648	0,025362128
Germany	110	2012	939083,31	5,82408381	2,856140674	14,34662161	12,38408003	-1,4232092	0,376483651	3,56875	74,688	22,77420893	7,271366583	32,5	43931,69171	-1,691348956
Greece	111	1990	104926,55	0	2,821283939	4,979253112	7,806882829	0,92924622	0	0,375	71,467	.	4,483876828	29	9673,415639	0,665839349
Greece	111	1991	104525	0	2,07945014	5,960264901	8,316860245	1,20859249	3,100026788	0,4375	71,635	.	5,243821365	29	10289,36709	0,973789652
Greece	111	1992	105963,36	0	1,894895445	6,184056272	7,899383367	1,27143623	0,699945557	0,46875	71,757	.	5,072207473	29	11249,23129	1,101272936
Greece	111	1993	105049,8	0	4,063829127	6,860551827	7,994610309	1,08674719	-1,600004773	0,71875	71,878	.	8,090603571	29	10435,22758	0,918270825
Greece	111	1994	107814,49	9,52215481	3,327315483	6,997084548	8,037284004	0,99948016	2,000015157	1,25	71,998	.	5,856012613	29	11089,85246	0,832668776
Greece	111	1995	109717,66	8,62888718	3,639446453	5,920550038	8,311389435	0,93583173	2,099736168	1,25	72,119	12,07153019	6,706059744	29	12918,73958	0,767912278
Greece	111	1996	112765,57	6,96438217	3,75750372	6,849315068	8,209180189	0,86705316	2,954972813	1,21875	72,239	11,13602327	5,828721638	29	13685,32056	0,700804487
Greece	111	1997	117585,67	7,56232119	3,388809188	7,086151132	7,834037813	0,79135917	4,46261271	1,21875	72,358	10,07110205	5,392813302	29	13298,44494	0,626754469
Greece	111	1998	123176,58	6,5543623	3,261233173	5,263157895	7,380367638	0,70593263	4,057618192	1,21875	72,478	9,927293594	5,050476326	29	13375,14922	0,540235109
Greece	111	1999	123027,51	5,64002037	3,222294288	6,018518519	7,834060124	0,6033409	3,073987015	1,21875	72,597	10,63594879	4,804810069	29	13140,06078	0,439278596
Greece	111	2000	126578,61	6,96216488	4,951151414	6,006944444	7,52078593	0,48397793	3,96737279	1,3125	72,716	10,61456046	6,807881758	29	11960,66447	0,320201198
Greece	111	2001	127510,38	7,70701551	4,082585724	6,551240056	6,813729856	0,58407543	3,736916514	1,3125	72,913	11,16614304	5,66758274	29	12418,67912	0,313518153
Greece	111	2002	127446,22	6,87617254	3,312837265	6,553398058	7,015577584	0,82483988	3,162447204	1,3125	73,303	11,02753451	4,819306421	29	13903,69055	0,291391047
Greece	111	2003	131257,18	6,75552082	3,944229532	9,56937799	7,28268485	0,83973405	6,637943352	1,3125	73,689	10,2037552	6,078418668	29	18292,00986	0,31452554
Greece	111	2004	131706,68	6,99122047	4,114562374	10,70559611	7,525492056	0,85865638	4,952469668	1,28125	74,073	9,694125105	6,381095095	29	21676,43092	0,33890501
Greece	111	2005	135310,59	6,63599443	3,589971331	10,49382716	7,714832322	0,84612772	0,890703642	1,95625	74,452	9,567085728	5,684074428	29	22327,00809	0,335768079
Greece	111	2006	131793,69	6,59810877	3,09352672	12,34567901	8,20654302	0,81773777	5,815236248	2,14375	74,827	9,545447154	5,165577644	29	24557,87761	0,315325591
Greece	111	2007	134636,56	6,54283142	2,11181436	14,3812709	7,926601228	0,81043791	3,537636802	1,64375	75,199	9,594830644	4,323239713	29	28548,30445	0,314522535
Greece	111	2008	130758,06	6,55509806	1,238372359	14,83180428	8,130110922	0,69922626	-0,444293912	1,575	75,568	9,624173216	10,19952388	29	31700,49412	0,209732392
Greece	111	2009	124109,98	6,70999527	1,139374038	14,56483126	8,940634437	0,4863018	-4,394817224	1,78125	75,932	8,54388019	5,269455177	29	29485,50983	0,005774683
Greece	111	2010	117877,65	8,39177513	0,9240041	16,84981685	11,12152625	0,17191486	-5,448755761	2,03125	76,292	8,192623498	4,078971112	29	26863,01161	-0,301076222
Greece	111	2011	114728,07	8,65318203	0,865022203	19,52662722	11,12405286	0,19535052	-8,863679768	2,03125	76,649	8,891921921	4,070851494	29	25962,36894	-0,271503978
Greece	111	2012	110985,47	.	1,358067949	16,43192488	13,89544037	0,18282957	-6,571893179	1,88125	77	9,099800058	5,369320587	29	22494,37819	-0,274055104
Hungary	112	1990	97602,59	0	0	6,688624272	3,866266597	-0,9905789	.	.	65,838	.	0	21	.	-1,033117297
Hungary	112	1991	89744,26	0	0	6,480446927	4,284613629	-0,1957104	.	.	65,713	.	0	21	3331,539529	-0,005668183
Hungary	112	1992	79723,71	0	0	7,473200613	4,895578407	-0,2310538	-3,064180345	.	65,587	.	0	21	3714,235212	-0,039136583
Hungary	112	1993	80262,61	0	0	7,393899204	5,058399534	-0,3063382	-0,576108517	.	65,461	.	0	21	3852,344109	-0,114035594
Hungary	112	1994	79214,82	6,98517752	0	7,262402869	5,121164807	-0,3295475	2,947154556	.	65,335	.	0	21	4150,056582	-0,136883104

Hungary	112	1995	78474,71	6,85906839	0	5,25136884	5,432140298	-0,3322554	1,489525476	0,46875	65,209	21,46652048	0	21	4469,595669	-0,139220004
Hungary	112	1996	80706,49	7,00403643	0	5,374499714	5,155903636	-0,365187	0,033920777	0,46875	65,083	21,26411755	0	21	4504,675741	-0,171771609
Hungary	112	1997	79269,91	7,45370388	0	5,724001133	5,240392496	-0,3967859	3,372380995	0,46875	64,956	22,93170873	0	21	4574,145115	-0,201458936
Hungary	112	1998	79095,35	8,86035156	0	4,894706887	5,200282218	-0,4283814	4,208477673	0,5	64,829	23,39395116	0	21	4728,791656	-0,232679337
Hungary	112	1999	79687,63	8,49666595	0	5,072266158	5,169781177	-0,4793526	3,238122459	0,46875	64,702	22,74927589	0	21	4782,97693	-0,28326061
Hungary	112	2000	76504,3	7,67459869	0	5,015854713	5,178559365	-0,4562402	4,240403543	0,8125	64,575	22,42612687	0	21	4613,705812	-0,259764908
Hungary	112	2001	78359,24	7,25887585	0	5,591524426	5,131558376	-0,0823848	3,735111432	1,4375	64,67	22,22114104	0	21	5254,772407	-0,229379183
Hungary	112	2002	76879,85	7,11995459	0	6,652512385	5,177163579	0,34878288	4,491147133	1,46875	65,081	21,38433897	0	21	6631,448498	-0,284751377
Hungary	112	2003	79604,12	7,14801741	0	7,627118644	5,018562817	0,33851128	3,778347149	1,90625	65,489	21,56340922	0	21	8365,464605	-0,286433268
Hungary	112	2004	79106,67	7,97653246	0	7,80141844	4,638974181	0,39812157	4,789353064	1,875	65,896	22,00732983	0	21	10206,32509	-0,221439379
Hungary	112	2005	78376,04	7,96543598	10,2780345	5,976095618	4,674846352	0,4937488	4,259657825	2,1125	66,354	22,04134599	21,75455924	21	11092,4308	-0,198878843
Hungary	112	2006	77485,25	8,09983349	9,958611182	12,06543967	5,375725339	0,60845379	3,962944387	2,08125	66,863	22,69546809	21,18177822	21	11342,89055	-0,155716485
Hungary	112	2007	75650,65	7,56918955	3,521501566	12,19512195	6,154667388	0,59752637	0,51127922	1,8625	67,368	22,25293317	5,587712142	21	13781,14079	-0,154915158
Hungary	112	2008	73327,97	7,33475447	3,521506383	13,80042463	6,77067239	0,56729615	0,878582396	2,05625	67,87	21,43662076	5,58788048	21	15598,32289	-0,175097367
Hungary	112	2009	66975,65	7,22816753	3,728133036	11,45631068	8,414401749	0,57324696	-6,551029707	2,15	68,366	20,33080563	5,108906399	21	12906,7504	-0,154908814
Hungary	112	2010	67637,97	7,3911047	2,45102002	17,08860759	9,053425824	0,49251807	0,78911688	2,23125	68,859	21,70214533	3,792045343	21	12958,2707	-0,226013876
Hungary	112	2011	66034,09	7,20780468	2,012877103	15,45253863	9,642452906	0,42427089	1,806605435	2,16875	69,348	22,08972916	2,833535984	21	13983,49764	-0,283360436
Hungary	112	2012	61980,66	7,43546867	1,650781418	11,45374449	10,18549957	0,17906813	-1,477944687	2,06875	69,832	22,38662709	3,564745058	21	12784,29561	-0,516437607
Iceland	113	1990	3538,08	0	0	7,692307692	61,81629622	1,02707212	1,169371126	.	90,75	.	0	0,4	25675,11149	0,777662199
Iceland	113	1991	3373,69	0	1,309974747	3,603603604	61,59934277	1,35933805	-0,223522038	.	90,932	.	8,883481339	0,4	27109,39742	1,15914942
Iceland	113	1992	3280,55	0	1,693920663	.	61,44016568	1,45426618	-3,373885981	.	91,112	.	10,76688078	0,4	27434,35291	1,256632077
Iceland	113	1993	3342,65	0	0,563185718	2,586206897	61,90853321	1,20895495	1,313445482	.	91,287	.	4,813957818	0,4	23849,3552	1,016811928
Iceland	113	1994	3275,95	8,94988346	0,55225869	6,194690265	60,04451499	1,05609906	3,608853618	.	91,46	.	4,651162791	0,4	24293,20645	0,866835947
Iceland	113	1995	3315,39	9,24846935	0,420326921	8,333333333	61,61597389	0,7281188	0,116591723	.	91,63	.	3,860883506	0,4	26938,06206	0,542467998
Iceland	113	1996	3405,79	9,40341759	0,663436777	7,5	57,83705548	0,72204535	4,785052973	.	91,797	.	3,23968892	0,4	27987,43538	0,539913017
Iceland	113	1997	3559,14	9,51445866	0,552664488	5,084745763	60,2415433	0,99640879	4,913193465	.	91,96	16,67871638	3,304400484	0,4	28107,57571	0,819197091
Iceland	113	1998	3690,18	8,85545826	0,738789146	6,130268199	61,84381609	1,24597055	6,438227634	.	92,121	15,69150635	2,365585554	0,4	30979,93478	1,070859043
Iceland	113	1999	3919,17	8,57943249	0,677952919	4,240282686	65,21818509	1,36748619	4,162772023	.	92,267	14,19930723	2,216633828	0,4	32271,02622	1,209238786
Iceland	113	2000	3902,65	8,0086689	0,517053582	3,039513678	65,64450048	1,51427859	4,74007585	.	92,401	13,73791732	2,475715411	0,4	31819,70622	1,369192833
Iceland	113	2001	3869,83	6,77603054	0,595963535	6,130268199	67,04175341	1,47121309	3,762961518	.	92,532	15,4104826	2,217565065	0,4	28589,74345	1,329295255
Iceland	113	2002	3902,75	6,45270729	1,453111675	2,43902439	67,00149378	1,03299844	0,453452076	.	92,662	13,40244931	3,419021143	0,4	31945,12952	0,892596377
Iceland	113	2003	3878,58	6,88271284	0,486159957	8,154506438	67,14250685	0,82943049	2,711438159	.	92,789	12,53227458	2,336429266	0,4	39114,24315	0,69249762
Iceland	113	2004	3931,18	7,11822271	0,350435181	3,583061889	66,23243335	1,01255999	8,228620875	.	92,914	12,31489785	2,085982336	0,4	47032,53387	0,877936158
Iceland	113	2005	3859,26	7,3108201	0,362792845	2,486187845	66,32064568	1,71490183	6,00194571	.	93,037	10,60962986	1,951385759	0,4	56611,30377	1,582891978
Iceland	113	2006	4390,94	6,74924231	4,165298013	3,167420814	67,45392093	2,47851964	4,232900251	.	93,159	10,75057693	5,096642175	0,4	56293,79023	2,34742243
Iceland	113	2007	4619,47	6,64592314	3,981191223	6,818181818	67,30296001	2,6579997	9,722501818	.	93,278	9,167989157	4,773462783	0,4	68835,30643	2,530085489
Iceland	113	2008	5021,79	5,53173828	3,570754798	15	73,923789	1,98483023	1,150661157	.	93,395	12,64439285	5,111736155	0,4	55446,76303	1,859572171

Iceland	113	2009	4779,27	5,45695448	2,409989498	10	74,97280277	0,46543722	-5,149588659	.	93,511	12,756776	3,403749569	0,4	40263,28263	0,341241979
Iceland	113	2010	4646,16	6,21571684	2,953361841	.	76,10116967	-0,0231701	-3,067113678	.	93,624	14,6327811	3,912374777	0,4	41695,89459	-0,143903
Iceland	113	2011	4441,13	6,08011961	3,164747528	16,66666667	77,267506	0,42293139	2,40098108	.	93,734	14,56841117	3,88330553	0,4	46042,37062	0,305468368
Iceland	113	2012	4467,73	5,9909997	3,53541137	33,33333333	78,13932369	0,64501836	1,309806059	.	93,84	12,75588772	4,171815872	0,4	44377,3739	0,532100735
Ireland	114	1990	55246,27	0	1,173970406	3,046697039	2,279782522	0,29548599	8,46652742	0,46875	56,906	.	2,803900942	10	14017,27791	0,084413021
Ireland	114	1991	56017,48	0	0,969283756	3,694347963	2,229176532	0,8206626	1,92953894	.	57,046	.	1,590395699	10	14073,12646	0,574927781
Ireland	114	1992	56006,31	0	0,647294373	3,446502058	2,158727414	1,06541047	3,343358542	.	57,265	.	0,933967838	10	15698,68053	0,682256778
Ireland	114	1993	56322,71	0	1,105857705	4,063205418	2,107049596	0,88154682	2,69255764	.	57,484	.	1,219401581	10	14642,43207	0,499840487
Ireland	114	1994	57752,38	9,14137173	1,26353351	1,711491443	2,175584862	0,77272285	5,755820272	.	57,702	.	1,452791884	10	15887,04837	0,394187639
Ireland	114	1995	58903,21	9,23969364	1,325345991	2,876106195	1,922435735	0,88977768	9,634491855	.	57,92	22,96244622	1,48817902	10	19139,33956	0,512695055
Ireland	114	1996	61001,23	9,34215927	1,770873127	2,266288952	1,934753625	1,17726053	9,08410279	.	58,144	23,03716846	1,906506	10	20809,8239	0,791271347
Ireland	114	1997	62510,37	9,23693848	1,949435846	4,126213592	1,900738676	1,43355647	10,77811485	.	58,395	24,52637538	2,106548619	10	22496,12454	1,002814735
Ireland	114	1998	65317,47	9,27215099	1,69625279	3,191489362	2,277731008	1,47030889	8,548848106	.	58,645	25,78693689	1,775646746	10	24190,06626	1,043076836
Ireland	114	1999	66281,89	9,31515121	1,431474159	3,903903904	2,056848964	1,55437617	10,20136244	.	58,896	26,51762179	1,431474159	10	26244,25233	1,127299556
Ireland	114	2000	68216,34	9,07812405	0,364068015	4,444444444	2,034166888	1,7566011	9,520995291	.	59,146	26,03624305	0,364165364	10	26100,66682	1,333042666
Ireland	114	2001	70207,5	7,93986273	0,320407493	3,525641026	1,971607664	2,01226813	5,273287461	.	59,395	28,44948278	0,320329391	10	28051,83547	1,59215149
Ireland	114	2002	68337,7	8,30839634	0,835864953	2,413793103	2,235429173	2,11188096	5,838314401	0,8125	59,649	30,2327902	1,285962632	10	32354,30565	1,685148857
Ireland	114	2003	68467,13	8,11477089	0,643370903	2,553191489	2,008241121	2,09058468	2,957232992	1,375	59,925	26,34140473	1,097664971	10	40904,59483	1,628950962
Ireland	114	2004	68184,47	8,30327797	1,285437058	3,043478261	2,295333537	2,28949668	4,578394171	1,40625	60,202	24,0749658	1,928903202	10	47425,63632	1,828313818
Ireland	114	2005	69655,66	8,20180607	0,907821326	4,727272727	2,878633003	2,63445606	5,674197946	1,7375	60,477	22,44647772	1,794114506	10	50569,07776	2,178703014
Ireland	114	2006	69165,75	7,74124956	0,9076137	5,466237942	3,200278207	3,14970062	5,470139737	1,8125	60,752	21,20303942	2,935058336	10	53944,02231	2,696005644
Ireland	114	2007	68370,74	7,85074568	0,055457284	8,582089552	3,551323559	3,33930821	4,932182698	1,6125	61,025	20,30507686	3,634987559	10	61218,61871	2,890960005
Ireland	114	2008	68020,49	8,41583729	1,332082742	7,885304659	4,150521025	2,48509281	-2,609651126	1,68125	61,298	19,6750971	4,342227854	10	60968,83763	2,038708011
Ireland	114	2009	62312,26	8,44342613	1,747507072	11,93415638	5,24318176	1,45677859	-6,370677442	2,025	61,569	22,77470314	4,761885673	10	51496,63335	1,015663276
Ireland	114	2010	61894,9	9,02550411	1,705048738	8,370044053	5,25910935	0,98408156	-0,27550501	2,075	61,84	22,21772301	5,273963578	10	47903,68133	0,544884384
Ireland	114	2011	57749,96	8,8791256	1,736323768	10,66666667	7,087413904	0,80149574	2,772706339	2,29375	62,111	23,77771127	2,796214746	10	51948,34654	0,364213884
Ireland	114	2012	58531,24	8,46383762	1,275636997	14,46540881	6,955112783	0,66227764	-0,313052822	1,94375	62,386	21,53727788	1,847407668	10	48391,31497	0,220500759
Italy	115	1990	519054,9	0	2,234290749	2,936155685	3,781464169	0,05373938	1,985771745	0,65625	66,726	21,77582455	8,097575926	29	20764,65293	0,083708573
Italy	115	1991	520606,01	0	2,821349802	2,96278739	4,669413667	0,03925354	1,538444721	0,6875	66,706	20,88655074	7,889921963	29	21892,07928	0,069231189
Italy	115	1992	517782,73	0	2,193171987	2,444070865	4,839464086	0,1218786	0,834276546	1	66,742	20,36939068	5,825296459	29	23175,24506	0,067924433
Italy	115	1993	511266,65	0	2,373699755	3,32239002	4,771496297	0,1509932	-0,852803497	1,0625	66,802	20,10047006	5,764263662	29	18683,7589	0,061135853
Italy	115	1994	503551,64	9,36585331	2,410919032	3,037026765	5,248023268	0,11014932	2,15102	1,0625	66,862	20,41832363	5,84472444	29	19280,86697	0,020372074
Italy	115	1995	530332,58	9,49704647	2,417501373	2,807607711	4,462278902	0,09128448	2,886842345	1,0625	66,922	20,88577016	5,53655138	29	20603,89332	0,001588562
Italy	115	1996	524037,79	8,85516548	2,384772558	2,781181083	4,748914305	0,11772095	1,286836647	1,0625	66,982	20,43090155	5,954214436	29	23028,50611	0,028104408
Italy	115	1997	530463,76	8,46226788	2,436762539	3,2076797	4,831419085	0,14244375	1,835875849	1,125	67,042	20,31730622	6,501894506	29	21787,70178	0,05290695
Italy	115	1998	541857,68	8,24812222	3,43323376	2,932889344	4,757626237	0,1182297	1,617192115	1,125	67,102	20,34722753	8,414645305	29	22260,81222	0,028774016
Italy	115	1999	548318,91	8,30668259	2,743252694	3,110846246	5,022460202	0,10619841	1,561115064	1,125	67,162	19,81878091	7,316780948	29	21945,50687	0,016820844

Italy	115	2000	551237,06	7,61566782	2,250319392	3,790232385	5,120159859	0,13459994	3,710147882	1,28125	67,222	19,5384707	6,207635998	29	20059,21077	0,045303631
Italy	115	2001	557143,87	7,32170486	2,280905322	6,580909769	5,382566167	0,14538397	1,77280302	1,1875	67,282	18,95575715	5,918281621	29	20409,00354	0,056167601
Italy	115	2002	558301,69	7,01074553	0	4,823339686	4,867189385	0,2974339	0,250778376	1	67,382	18,55859399	0	29	22205,84193	0,148916429
Italy	115	2003	573604,49	7,20337105	0	4,404426123	4,573160113	0,62095642	0,152649957	1,05	67,501	17,79232125	0	29	27399,10512	0,444507313
Italy	115	2004	576843,08	6,92136097	0	7,202393674	5,223046774	0,82332128	1,583269711	1,1	67,62	17,58970891	0	29	31188,62272	0,647182705
Italy	115	2005	574261,76	6,88463306	2,717675128	7,121119903	4,831755066	0,66574173	0,949620808	1,66875	67,738	17,21928226	6,70506584	29	31973,93474	0,491389108
Italy	115	2006	563373,42	6,5796237	2,567027947	7,770069376	5,365413925	0,47460793	2,006401731	2,18125	67,856	17,39956597	6,517745579	29	33426,16606	0,300559689
Italy	115	2007	555077,9	6,17279053	3,468280974	8,737864078	4,997718052	0,67868172	1,474124078	2,08125	67,974	17,74210188	6,662478745	29	37716,44913	0,504933687
Italy	115	2008	540620,5	5,81700706	4,092541798	8,360175695	6,276563147	0,83591495	-1,049824651	2,0875	68,092	17,0924668	10,01967212	29	40659,67042	0,662469253
Italy	115	2009	490112,81	6,17002869	3,179460638	9,109663409	8,633823757	0,62729274	-5,481378532	2,20625	68,209	15,15804089	7,314078718	29	36995,10735	0,45561345
Italy	115	2010	499358,6	6,11204195	3,004817662	9,177695813	10,09366364	0,48043895	1,710582418	2,2875	68,327	15,80412893	6,642231707	29	35877,87149	0,307591222
Italy	115	2011	486601,13	6,26846552	3,484185477	9,224553922	11,10023485	0,34306635	0,586820837	2,25	68,444	15,77767127	7,308926777	29	38364,94175	0,171978291
Italy	115	2012	460083,45	6,79086924	3,356265497	8,541905855	12,09201527	0,43887964	-2,770415892	2,23125	68,56	15,3723766	7,066186954	29	34854,39756	0,26954124
Japan	116	1990	1234320,12	0	0,47369099	4,503277482	4,426406689	0,50442218	5,572398298	0,78125	77,339	25,92811565	23,03319841	68,5	25123,63178	0,341370597
Japan	116	1991	1245823,29	0	0,531235584	4,948508683	4,586208437	0,48346929	3,324340789	0,78125	77,473	25,84423647	22,38361356	68,5	28540,77148	0,310355946
Japan	116	1992	1256111,75	0	0,53225442	4,991758066	4,084221026	0,42491716	0,819029861	0,78125	77,61	24,90751696	21,87788405	68,5	31013,64715	0,248237081
Japan	116	1993	1250768,52	0	0,534671464	5,52197285	4,319422045	0,42190156	0,171062707	0,78125	77,746	23,50511701	21,74886956	68,5	35451,29751	0,246819413
Japan	116	1994	1314837,52	6,44476795	0,5433997	5,878410603	3,445342607	0,5141767	0,863578252	0,875	77,881	22,05508816	21,08731912	68,5	38814,89438	0,340685789
Japan	116	1995	1335888,27	6,35159492	0,558982563	6,038334183	3,817232187	0,55498109	1,942343417	0,9375	78,016	22,2039991	20,96574461	68,5	42522,06659	0,381789601
Japan	116	1996	1349668,79	6,42812061	0,57627672	6,070759454	3,751313666	0,41840363	2,610054635	0,96875	78,145	22,17968231	23,83352992	68,5	37422,86414	0,25318888
Japan	116	1997	1343308,19	6,24191475	0,568771604	6,353413243	4,030040765	0,4006573	1,595628581	1,71875	78,272	22,03938977	20,72886739	68,5	34304,14897	0,238271218
Japan	116	1998	1300747,04	6,4556179	0,610978947	6,426801009	4,014320901	0,43257733	-2,003147841	1,71875	78,398	21,41936303	20,51330117	68,5	30969,73803	0,27172961
Japan	116	1999	1321896	6,6985817	0,710513782	6,699486182	3,808998881	0,34190211	-0,199337304	1,71875	78,523	21,05683311	19,98116487	68,5	35004,06127	0,182586374
Japan	116	2000	1340522,55	6,47782898	0,799158908	6,967000361	3,863439128	0,32760957	2,257495292	1,78125	78,649	21,16932718	18,86469515	68,5	37299,64413	0,167275578
Japan	116	2001	1315673,33	6,55541039	0,848577593	7,169529893	3,708331931	1,93162376	0,355461713	1,78125	79,99	19,88210727	18,2413696	68,5	32716,41867	0,240952588
Japan	116	2002	1347823,81	6,84838772	0,863494561	7,245317975	3,679682106	2,28287211	0,289548448	1,78125	81,647	19,37315494	18,40179011	68,5	31235,58818	0,232527187
Japan	116	2003	1351663,74	6,94221115	0,86830277	7,530490647	4,068205577	2,09340015	1,685111736	2,01875	83,196	19,53057858	18,07286221	68,5	33690,93773	0,213980949
Japan	116	2004	1347639,97	6,69520855	0,865657033	7,531722492	3,974679163	1,75443199	2,360730112	2,26875	84,64	19,72942706	17,98525801	68,5	36441,50449	0,033662258
Japan	116	2005	1350321,36	6,40693998	0,81599795	7,348568113	3,657136419	1,57784067	1,302728139	2,3	85,978	19,91551866	17,65172503	68,5	35781,17005	0,009392097
Japan	116	2006	1332532,63	6,09341764	0,809744896	7,644902214	3,983979492	1,31053643	1,692904249	2,26875	87,057	19,92246231	16,03389603	68,5	34075,97895	0,063373589
Japan	116	2007	1364257,69	5,89110327	0,895603622	7,770044067	3,740117032	1,20705397	2,192186227	2,08125	88,013	20,32435891	15,57771906	68,5	34033,70125	0,114908848
Japan	116	2008	1280903,32	5,79302835	0,926292389	8,20081781	3,928790201	1,06131019	-1,041636025	2,08125	88,909	19,86415671	14,67275233	68,5	37865,61803	0,048425395
Japan	116	2009	1205672,64	6,1847353	0,982344146	8,967731266	3,984337115	0,92117041	-5,526976489	2,1125	89,743	17,83537893	14,14859978	68,5	39322,60473	-0,012494631
Japan	116	2010	1256094,69	5,81606102	1,059288702	9,268517325	4,497484758	0,8822489	4,652030143	2,33125	90,522	19,70302936	13,28048889	68,5	42909,23415	0,017960542
Japan	116	2011	1306517,93	5,55425215	1,071257389	9,754846303	4,626105474	0,60128947	-0,45272483	3,28125	91,248	18,61206037	14,32977076	68,5	46203,70952	-0,197526884
Japan	116	2012	1343117,72	.	2,028883497	9,339957746	4,481487294	0,51385144	1,753689775	3,15625	91,902	18,60356154	13,38762727	68,5	46679,26543	-0,200320559
Korea	117	1990	295683,24	0	0	4,138903127	1,631946593	3,30864873	9,297330585	.	73,844	25,04614866	0	65	6642,451218	0,985130494

Korea	117	1991	318013,45	0	0	4,48345392	0,955805038	2,50578148	9,712888661	.	74,972	25,20813491	0	65	7675,693138	0,989785982
Korea	117	1992	344297,55	0	0	4,637227381	0,752918877	2,16390258	5,765237321	.	75,82	24,47627027	0	65	8140,218706	1,039161356
Korea	117	1993	378825,89	0	0	4,557853494	0,725977951	2,09804804	6,329394213	.	76,645	24,56030923	0	65	8869,020761	1,015821437
Korea	117	1994	409043,01	10,0980759	0	4,366980325	0,44157431	2,05355923	8,771892964	.	77,452	24,92167708	0	65	10275,27753	1,006157245
Korea	117	1995	442839,97	10,7812452	0	3,660767045	0,443589557	2,01718442	8,930624243	.	78,239	25,34039614	0	65	12403,91322	1,006200855
Korea	117	1996	487603,22	11,8405294	0	4,154527582	0,608637294	1,49197609	7,185916566	.	78,662	24,45196979	0	65	13254,6374	0,952779422
Korea	117	1997	510258,49	12,6938429	0	4,386305944	0,676452143	1,24615224	5,766740748	.	78,905	24,02277852	0	65	12196,76978	0,937713809
Korea	117	1998	435745,26	12,7336035	0	3,779594849	0,948918668	1,02556798	-5,713897734	.	79,145	24,87188698	0	65	8133,731245	0,721865018
Korea	117	1999	477061,39	12,8094235	3,273695336	4,494585382	0,787124929	1,01231674	10,73058969	.	79,384	25,50532851	8,917500719	65	10432,2108	0,710794593
Korea	117	2000	511186,91	12,1537838	3,754280216	4,479731315	0,700449127	1,13428441	8,831278205	.	79,621	28,9762505	8,782512379	65	11947,57725	0,836180864
Korea	117	2001	530650,01	12,8720007	4,495560431	4,678239949	0,692195878	1,14005996	4,525319497	.	79,94	27,57467948	9,146776095	65	11255,94789	0,740212672
Korea	117	2002	548413,1	11,6376181	4,540255246	4,970668713	0,696660963	1,00571419	7,432433614	1,75	80,299	27,17511072	9,02235566	65	12788,58018	0,557631009
Korea	117	2003	559121,86	11,2536278	4,400367615	5,107045943	0,845579278	0,93535234	2,933207053	2,4375	80,652	26,68238988	9,053576857	65	14219,19359	0,496708812
Korea	117	2004	566147,76	10,7121439	4,605289277	4,696400692	0,77020122	0,80863653	4,899851507	2,5	81,002	28,51319615	10,64676359	65	15921,9392	0,375613356
Korea	117	2005	569465,82	10,2574625	4,631275729	5,338114457	0,872923455	0,62771942	3,92368744	3,0625	81,345	28,27523759	12,48358995	65	18657,52186	0,205166578
Korea	117	2006	575193,1	9,52779293	4,622109259	6,152392286	0,948657677	0,70936724	5,176133982	3,375	81,528	27,81369361	10,80963632	65	20917,02989	0,484653201
Korea	117	2007	591429,06	9,53759098	3,196720086	6,661041515	1,024921542	0,59177674	5,463406088	3,375	81,631	28,20206829	11,69581269	65	23101,51118	0,465519941
Korea	117	2008	605406,51	9,23872662	3,243418107	7,535184455	1,046210628	0,84462976	2,829214457	3,8125	81,733	28,60099207	12,78859083	65	20474,88747	0,719755307
Korea	117	2009	609167,15	8,38619137	2,431471095	9,377369558	1,185344062	0,60029068	0,707518483	3,9375	81,835	28,72357933	11,42429005	65	18338,70637	0,475570549
Korea	117	2010	667755,38	10,015542	2,259415508	9,962452361	1,287782319	0,58651774	6,496785169	3,9375	81,936	30,71899369	10,53104743	65	22151,20912	0,46317647
Korea	117	2011	697707,98	9,36624336	2,19367204	10,45927374	1,322460379	0,86737247	3,681704667	3,875	82,037	31,36650732	12,02993939	65	24155,8293	0,744180714
Korea	117	2012	.	9,57377911	0	9,717132349	1,598824499	0,57766995	2,292382426	3,26875	82,141	31,00472402	10,99633722	65	24453,97135	0,450977411
Luxembourg	118	1990	12901,05	0	0	3,448275862	1,721832849	1,32089927	5,320359584	.	80,947	.	0	33,5	34872,09687	1,251745707
Luxembourg	118	1991	13446,77	0	0	7,01754386	1,700140322	1,56550867	8,644169661	0,40625	81,13	.	0	33,5	37249,90117	1,33968317
Luxembourg	118	1992	13221,73	0	0	10,6918239	2,012048413	1,81761499	1,819615597	0,4375	81,528	.	0	33,5	41234,18451	1,328347571
Luxembourg	118	1993	13333,88	0	0	8,474576271	1,991926727	1,74521902	4,200719	0,53125	81,857	.	0	33,5	41750,8423	1,342387029
Luxembourg	118	1994	12505,1	8,78458881	0	11,42857143	2,820827716	2,12262151	3,820596164	0,53125	82,482	.	0	33,5	45779,89571	1,361840137
Luxembourg	118	1995	10177,49	8,00545883	0	8,24742268	3,990912899	1,90181617	1,432357058	0,53125	82,893	12,8949449	0	33,5	53177,39097	1,404742464
Luxembourg	118	1996	10238,59	7,7897644	0	8,396946565	3,065370317	1,27897737	1,514840273	0,53125	82,825	11,68036698	0	33,5	52219,17702	1,361143941
Luxembourg	118	1997	9534,45	7,54829216	0	4,081632653	4,386334228	1,19804591	5,937809693	0,53125	82,779	12,28964323	0	33,5	46394,81874	1,253502484
Luxembourg	118	1998	8644,45	7,4597187	0	6,18556701	6,730012502	1,38147447	6,491490143	0,53125	82,893	12,21064394	0	33,5	47893,06972	1,243870803
Luxembourg	118	1999	9062,37	7,34630728	0	9,345794393	5,863169334	2,01786761	8,420219934	0,53125	83,448	10,73728487	0	33,5	51728,29824	1,350621285
Luxembourg	118	2000	9762	7,11063719	1,851778105	17,6	6,852523948	2,26003451	8,44203498	0,625	84,216	10,58954009	4,15471638	33,5	48826,54579	1,344082996
Luxembourg	118	2001	10258,25	7,10890675	3,505005078	20,79207921	3,432128516	1,93230878	2,000093883	0,625	84,843	10,24057187	5,157659618	33,5	47558,37221	1,190456345
Luxembourg	118	2002	11036,51	7,07467937	4,235903659	21,56862745	1,312543808	1,5837489	3,27592224	0,625	85,299	9,791782393	6,36435773	33,5	52190,06556	1,047660816
Luxembourg	118	2003	11381,76	7,31498957	3,602098804	.	1,271456572	1,73429507	1,190153476	0,625	85,743	10,03089935	7,058310943	33,5	64422,27899	1,21520088
Luxembourg	118	2004	12862,16	8,19445992	3,503614198	2,040816327	1,36150281	1,92636779	4,926274688	0,625	86,177	9,706226445	6,739329844	33,5	74674,13317	1,421332565

Luxembourg	118	2005	13095,2	7,85522604	3,70589906	5,357142857	1,89064414	2,01739309	4,124201705	0,95625	86,598	8,927662367	6,811642525	33,5	79595,53408	1,530054663
Luxembourg	118	2006	12946,34	7,34242868	3,12210256	7,692307692	2,091701923	2,06848436	4,881194704	0,95625	87,009	8,000877245	5,969723191	33,5	88400,20327	1,595051918
Luxembourg	118	2007	12360,72	7,14744568	2,852622398	2,739726027	3,633885373	2,00297021	6,463173267	0,95625	87,409	9,11308949	5,568553731	33,5	102523,3949	1,544386847
Luxembourg	118	2008	12188,4	7,07585049	3,389638363	3,614457831	3,964498642	2,2339108	0,487325037	1,35625	87,8	7,95919632	6,172499609	33,5	112477,0611	1,787496632
Luxembourg	118	2009	11683,85	6,62957859	4,968601961	9,89010989	3,736658555	2,28128376	-5,33368059	1,45	88,178	5,253745993	7,321676202	33,5	100735,3519	1,85177523
Luxembourg	118	2010	12249,56	6,44010735	3,191267127	10,1010101	3,662085681	2,2430986	5,144673181	1,46875	88,547	5,850965446	5,630712681	33,5	102863,0957	1,825405804
Luxembourg	118	2011	12124,93	6,4710784	3,69994304	11,11111111	3,71949169	2,62729268	2,609030403	1,46875	88,906	5,652148753	5,295185262	33,5	113731,6515	2,222660503
Luxembourg	118	2012	11839,24	6,19862413	4,130612713	7,575757576	4,142591761	2,7841896	-0,162966697	2,11875	89,247	5,579416708	5,552015341	33,5	106022,7991	2,4015419
Mexico	119	1990	458754	0	1,435281837	5,692031156	14,21756101	2,66539074	5,068306312	.	71,419	20,79800793	15,26966403	35	3068,702424	2,014994081
Mexico	119	1991	465556	0	1,137320497	5,930470348	13,02150027	2,56392935	4,222250716	.	71,816	20,58565488	14,5850529	35	3600,045185	2,009593578
Mexico	119	1992	465421	0	0,44084526	5,893813931	13,1971519	2,543837	3,628658714	.	72,209	20,24914122	13,67598367	35	4080,452175	1,998097147
Mexico	119	1993	475643	0	0,346578768	6,239054291	13,73216793	2,51186852	4,061425854	.	72,598	17,8736326	19,36029441	35	5544,932462	1,974599974
Mexico	119	1994	504613	10,7767239	0,644853369	5,444444444	12,32055621	2,46749377	4,727354829	.	72,985	17,15232994	17,03771131	35	5690,674713	1,935837771
Mexico	119	1995	487432	7,03695726	0,5896555	6,016042781	13,63695834	2,40839946	-5,75868238	.	73,368	19,1107928	11,67872522	35	3640,833419	1,885005572
Mexico	119	1996	504948	5,96749449	0,745824204	.	13,51023595	2,25205247	5,874766683	.	73,67	20,34479582	14,88181466	35	4131,805706	1,841273752
Mexico	119	1997	521523	7,50785017	0,834387824	5,754256302	13,0341785	2,14805963	6,962888801	.	73,929	20,89728833	35,29720954	35	4907,333152	1,797108948
Mexico	119	1998	545183	11,1694202	0,722375513	5,869405723	12,48815549	2,07463725	4,701842416	.	74,186	21,22317292	34,34223386	35	5038,629775	1,727609484
Mexico	119	1999	539291	12,4691362	0,877432559	6,788990826	13,03985693	1,97013595	2,667013147	.	74,441	20,68197272	24,10095611	35	5722,122139	1,626994775
Mexico	119	2000	564970	7,88980627	1,187103813	6,16758826	12,4492059	1,88802677	5,296473838	.	74,722	20,30467669	28,96342658	35	6649,716534	1,511256292
Mexico	119	2001	564562	9,47241116	0,991989639	6,442974165	11,61324108	1,81361985	-0,60549239	.	75,045	19,41123125	23,38434748	35	6952,289039	1,382283072
Mexico	119	2002	569646	11,450078	1,811587359	5,918456817	10,91156505	1,70161379	0,131917169	.	75,365	18,82389902	14,30044567	35	7023,787276	1,276108876
Mexico	119	2003	580256	8,03106594	1,946643453	6,985169252	10,61403002	1,6530014	1,422671242	.	75,682	18,17952003	12,05944089	35	6673,166974	1,23326386
Mexico	119	2004	612105	4,94094849	2,234422232	5,798176807	10,48803133	1,68836635	4,295714251	.	75,997	18,24095789	10,12515566	35	7115,121769	1,273015502
Mexico	119	2005	614648	2,19014454	2,08354732	5,748194014	10,7026477	1,77542639	3,032573659	.	76,308	17,2417888	8,998173083	35	7893,968234	1,367034911
Mexico	119	2006	643362	-0,94041	2,137273872	6,101550277	10,29204556	1,88286655	5,001385468	.	76,617	18,10847994	10,13520659	35	8680,60388	1,478745671
Mexico	119	2007	670204	-1,0876111	2,187215727	7,253101987	9,727750922	1,9632964	3,148225822	.	76,923	17,38679366	10,96196603	35	9222,883997	1,564702817
Mexico	119	2008	699201	-7,5070052	1,777133789	8,120578284	10,40829447	2,00195104	1,400290149	.	77,227	16,97697841	15,11078034	35	9578,570567	1,607530437
Mexico	119	2009	688927	1,39512742	1,782660937	9,230769231	9,627359149	1,97781012	-4,700339936	.	77,527	16,66870395	11,93121462	35	7661,208413	1,590096455
Mexico	119	2010	701360	-1,2131807	1,531905128	9,173318901	9,950746035	1,91441062	5,110198731	.	77,825	17,28651042	18,92368073	35	8861,493697	1,530765872
Mexico	119	2011	.	-4,4184427	1,588605069	9,988187426	9,631669892	1,8384444	4,044614776	.	78,118	17,07263411	20,70526776	35	9730,277753	1,462665986
Mexico	119	2012	.	-6,7311301	0	10,69399852	9,350894352	1,77642049	4,007370613	.	78,407	17,88574207	0	35	9721,062644	1,407149514
Netherlands	120	1990	211849,59	0	3,261164376	6,520905255	1,245854159	1,25510546	4,183228728	1,625	68,684	18,36963325	5,994153038	10,5	20936,88201	0,688603823
Netherlands	120	1991	216385,16	0	3,213376482	6,371049949	1,195385025	1,7227312	2,439125182	1,375	69,329	17,5674932	6,172676626	10,5	21370,91674	0,788031035
Netherlands	120	1992	215098,97	0	3,010784509	7,820954255	1,251795949	2,03732043	1,70607401	0,875	70,223	17,18001043	6,308018312	10,5	23506,61346	0,756056593
Netherlands	120	1993	219979,89	0	4,099058842	6,669798027	1,208572733	1,93813795	1,2575571	0,9375	71,1	16,95241523	6,961279096	10,5	22737,97763	0,69699133
Netherlands	120	1994	219933,69	7,83860159	3,90153901	6,21761658	1,245014079	1,80802282	2,961083147	1,21875	71,962	16,84513208	6,997139164	10,5	24236,54566	0,602938474
Netherlands	120	1995	223161,32	8,20971775	3,662125191	6,781153677	1,245144863	1,66406636	3,116027635	0,96875	72,809	17,17208028	6,953441077	10,5	28771,69291	0,493927373

Netherlands	120	1996	231327,16	9,04779053	3,415507244	6,812194204	1,156487941	1,59627352	3,052771241	1,1875	73,64	16,58241633	6,614329461	10,5	28498,68	0,461395748
Netherlands	120	1997	224605,61	8,94238567	3,844728246	7,106782107	1,360842385	1,61273226	4,024364161	1,46875	74,453	16,07662028	6,538576119	10,5	26250,37444	0,514767002
Netherlands	120	1998	225494,05	9,21746445	4,361278022	6,507508664	1,410726409	1,68142954	4,388620504	1,5	75,25	15,91556662	6,88987047	10,5	27450,71919	0,616640531
Netherlands	120	1999	213316,45	9,45480156	3,792078364	6,464872945	1,452332089	1,69670493	4,531572578	1,46875	76,03	15,46240637	6,559447083	10,5	27822,83658	0,665493187
Netherlands	120	2000	213023,12	9,60720348	3,471484087	7,274090739	1,515514694	1,7159221	4,377314499	1,3125	76,795	15,25104977	6,894522723	10,5	25958,15308	0,714770363
Netherlands	120	2001	214494,43	9,61909485	3,057204984	6,234413965	1,543015271	2,09358123	1,624014155	1,6625	77,83	14,89105143	6,821443564	10,5	26554,06303	0,754840058
Netherlands	120	2002	213544,38	9,40618706	2,691892635	7,053941909	1,701206235	2,27331418	-0,033597057	1,69375	79,113	14,20305805	5,161575703	10,5	28762,19453	0,638291666
Netherlands	120	2003	214303,67	9,73834705	2,510933857	6,003159558	1,692222715	2,01210346	0,265814998	2,00625	80,341	13,83329653	5,348826249	10,5	35186,87093	0,471814399
Netherlands	120	2004	215514,09	10,0339966	1,660627264	5,708502024	2,010692413	1,79694284	1,857332442	2,475	81,514	14,0212902	4,387344133	10,5	39678,81633	0,347475412
Netherlands	120	2005	209448,24	9,94711208	1,066413227	6,751054852	2,558548574	1,5934688	2,252460632	3,275	82,63	14,07886053	3,023862665	10,5	41199,72556	0,233663148
Netherlands	120	2006	205558,92	10,0298815	1,824756054	8,105906314	2,950234034	1,37073677	3,821283774	3,275	83,636	13,61626091	4,037223075	10,5	44011,28267	0,160613669
Netherlands	120	2007	204199,49	9,54716015	0,638037457	8,266309205	3,411366927	1,29141367	4,200058434	2,7125	84,539	13,6737057	2,923307828	10,5	50861,06642	0,217521601
Netherlands	120	2008	203313,53	9,5609417	0,411698019	9,056761269	3,622555142	1,40494529	2,077940596	3,40625	85,402	12,94459324	2,86993527	10,5	56628,75117	0,389292461
Netherlands	120	2009	197787,1	9,94989586	0,285555868	10,49868766	4,109905876	1,49306321	-3,298074702	4,08125	86,242	11,74034521	2,825106148	10,5	51909,5849	0,514284545
Netherlands	120	2010	209286,43	9,89749908	0,046694738	11,73421301	3,56090749	1,4580959	1,070503848	4,5375	87,061	11,8050504	2,96576142	10,5	50341,25192	0,512923101
Netherlands	120	2011	195063,51	9,70113087	0,849750614	11,21928605	4,363888323	1,35380735	1,663619434	3,94375	87,837	12,07387981	2,394882204	10,5	53537,27515	0,466428782
Netherlands	120	2012	191668,7	9,14896011	0,891437584	10,28659161	4,654838046	1,20674324	-1,585708514	4,09375	88,575	11,83114321	3,050492524	10,5	49128,08727	0,370055035
New Zealand	121	1990	60641,44	0	2,644300775	4,35483871	30,02453391	1,20209777	0,13997704	0,375	84,742	19,15762719	3,122928996	38,5	13663,03957	0,923222729
New Zealand	121	1991	61615,13	0	3,372319048	4,262877442	29,67324197	5,07010551	-1,088283505	0,28125	84,933	19,22155558	4,779394453	38,5	12230,08955 .	
New Zealand	121	1992	62986,84	0	3,191577105	4,234972678	27,60300752	1,16059892	1,113677678	0,28125	85,034	19,27576297	4,535864602	38,5	11793,1543	1,041735384
New Zealand	121	1993	62644,42	0	3,376962394	5,329536208	29,24305624	1,25776292	6,411493934	0,28125	85,134	19,29894289	4,798800382	38,5	13094,32997	1,140231107
New Zealand	121	1994	63734,65	4,96622849	0	5,576208178	30,19262821	1,44662848	5,105512862	0,28125	85,234	19,92608166	0	38,5	15280,24532	1,329237335
New Zealand	121	1995	64464,84	4,76452637	3,31405075	5,428403756	30,57952888	1,58042727	4,593383852	0,28125	85,333	19,1138327	5,159208555	38,5	17400,34786	1,464363787
New Zealand	121	1996	66618,86	4,80901289	0	5,778032037	29,45085788	1,68575644	3,6217814	0,28125	85,421	18,00255948	0	38,5	18794,5104	1,582661927
New Zealand	121	1997	69138,05	5,1147356	0,765492669	5,227844562	27,63287544	1,38723504	1,976409499	0,28125	85,485	17,61248581	2,153848534	38,5	17474,17036	1,312358286
New Zealand	121	1998	67013,77	5,45443201	0	5,880673708	29,55339367	0,96211752	0,602653171	0,53125	85,549	16,96869897	0	38,5	14738,47316	0,887279889
New Zealand	121	1999	68979,31	5,30824566	1,449215095	5,62819784	28,60588683	0,60027325	5,515497176	0,53125	85,613	16,72076469	3,260733964	38,5	15322,2509	0,525484536
New Zealand	121	2000	70898,9	5,03068018	0	5,279953583	28,88779208	0,66230735	2,763631571	0,53125	85,677	16,64364213	0	38,5	13641,05719	0,587564086
New Zealand	121	2001	73619,06	5,10402966	0	6,003480278	26,7905597	0,69076686	3,429305161	0,53125	85,764	16,29627388	0	38,5	13882,89997	0,589286035
New Zealand	121	2002	74330,99	4,98540211	0	7,013500165	28,66438239	1,8956393	4,885017281	0,53125	85,9	16,71708521	0	38,5	16895,45795	1,737174864
New Zealand	121	2003	76807,65	4,63291597	0	5,592208608	28,00927118	2,08989053	4,631515421	0,53125	86	15,8223937	0	38,5	21941,05064	1,973558544
New Zealand	121	2004	76206,61	4,09377575	0	5,920114123	30,4291662	1,51645418	3,816601827	0,53125	86,026	15,74098777	0	38,5	25461,13844	1,486219082
New Zealand	121	2005	78286,62	3,85641098	0	6,652631579	29,1773265	1,15899571	3,4107757	0,53125	86,052	15,69918332	0	38,5	27833,60146	1,12877351
New Zealand	121	2006	78185,8	3,78437233	16,00006279	8,083038869	29,4134017	1,24918446	2,763649358	0,53125	86,078	14,72983381	17,99990938	38,5	26630,35668	1,21898486
New Zealand	121	2007	76221,51	3,95978236	17,65793796	8,884401817	29,10808027	0,96261478	2,959127773	0,59375	86,104	13,55198985	19,19971991	38,5	32382,26671	0,932407688
New Zealand	121	2008	75763,7	3,88390613	16,88085586	9,666283084	28,08183068	0,87889315	-1,615141044	1,09375	86,13	13,80930942	18,39041835	38,5	30972,12382	0,848701402
New Zealand	121	2009	73101,16	4,15774059	17,1346455	11,76470588	30,15180979	1,0206215	-0,25135967	1,45625	86,148	12,59556848	18,72207185	38,5	27998,56192	0,999728031

New Zealand	121	2010	73491,33	4,36937237	11,52110343	10,33210332	31,34197415	1,13146269	1,441475845	1,45625	86,165	12,09056938	13,09123939	38,5	33394,06934	1,111726056
New Zealand	121	2011	74393,45	4,25123978	10,70599852	14,68978102	32,19922336	0,78336597	2,21839831	1,10625	86,183	12,14187504	12,21961656	38,5	37896,85961	0,762479795
New Zealand	121	2012	76047,98	4,14256096	10,71007901	17,15575621	30,78006985	0,56793165	2,177812333	0,70625	86,2	.	12,1010915	38,5	39573,81053	0,548220797
Norway	122	1990	50409,35	0	3,186183548	5,762144054	59,17374391	0,52220092	1,932438873	1,09375	71,956	11,60319318	7,311290489	33,5	28242,94374	0,344151413
Norway	122	1991	48320,85	0	3,577459162	6,416217221	60,78487833	0,9050355	3,084674239	1,875	72,265	11,22183023	7,680295593	33,5	28596,933	0,476503585
Norway	122	1992	46573,39	0	3,486087564	6,022705407	61,37896543	1,12915106	3,574481372	2,0625	72,665	11,30363611	7,548174597	33,5	30523,98506	0,577180268
Norway	122	1993	48491,89	0	3,331326139	5,979995744	61,09733461	1,1387337	2,845234641	1,65625	73,061	11,60585981	6,600584441	33,5	27963,66522	0,59522933
Norway	122	1994	50447,41	8,3994503	2,910751504	6,431248767	60,39895362	1,10447295	5,055453529	1,6875	73,453	11,88231685	5,688772264	33,5	29315,84191	0,569388228
Norway	122	1995	50241,89	8,51958084	2,782391976	6,331360947	60,04713171	0,94162748	4,153950574	1,46875	73,764	12,45074551	5,278931167	33,5	34875,19739	0,51912552
Norway	122	1996	53377,75	8,82852936	2,82294253	5,958010214	57,85055029	0,87900303	5,027995446	1,46875	74,039	11,5999318	5,166371387	33,5	37321,44339	0,506881683
Norway	122	1997	53329,81	8,65861607	2,940221337	4,995586937	58,83887382	0,9062369	5,284684789	1,5	74,309	11,56039006	5,194247716	33,5	36628,51742	0,542219936
Norway	122	1998	53502,03	8,08219051	3,020190276	6,305813742	59,51691355	0,68418213	2,624396897	1,5	74,375	12,1991835	5,423576531	33,5	34788,77856	0,595410343
Norway	122	1999	54529,36	7,59174824	3,009375592	5,292479109	59,41494964	1,63619614	2,013307554	1,46875	75,086	11,66859539	5,066053436	33,5	36371,39579	0,684759433
Norway	122	2000	54058,49	6,78557682	2,785275412	6,090925048	60,18812704	1,96550018	3,205285078	1,59375	76,081	10,029923	5,054479705	33,5	38146,71539	0,649044821
Norway	122	2001	55276,06	6,80734205	2,738205751	6,122826489	59,60640604	1,13496275	2,085328036	1,5625	76,561	10,08893681	4,728624561	33,5	38549,58934	0,506046911
Norway	122	2002	54140,02	6,92247152	2,593923051	5,868858727	59,49311024	1,10974922	1,437708803	2,125	76,999	10,08885457	4,699766803	33,5	43061,15038	0,539290805
Norway	122	2003	54886,35	6,91427135	2,439353259	6,992277186	56,25686952	0,88610257	0,919841886	2,125	77,23	9,989324801	4,732142791	33,5	50111,65445	0,586532692
Norway	122	2004	55438,48	6,865201	2,150418589	7,224236147	56,87160533	0,64915502	3,959038034	2,125	77,275	9,611925621	4,473437937	33,5	57570,26916	0,59093094
Norway	122	2005	54469,02	6,45349312	2,030945972	6,862530147	58,59181105	0,95892102	2,624720534	2,4875	77,49	9,145682029	4,925240167	33,5	66775,3944	0,681072964
Norway	122	2006	54288	6,22046947	1,868800963	7,900912647	57,05968286	1,31899028	2,395092466	2,4875	77,889	9,306388652	5,046926258	33,5	74114,69715	0,805392739
Norway	122	2007	56006,29	6,36705351	1,791579968	10,37091264	57,39006106	1,476693	2,929766044	2,425	78,234	9,340020306	4,465966947	33,5	85128,65759	1,034734515
Norway	122	2008	54424,51	5,67294645	1,912947546	9,828393136	58,49373492	1,61886675	0,38430604	2,64375	78,526	8,606220034	4,798311671	33,5	96880,50961	1,246333015
Norway	122	2009	51808,95	5,7132287	2,684524717	12,26145038	56,7709199	1,6284764	-1,622533268	3,7375	78,815	8,22776083	5,978863643	33,5	80017,77681	1,261127289
Norway	122	2010	54346,96	5,75062609	2,377951492	11,5146147	56,33486332	1,60915606	0,601934441	3,7375	79,102	8,080971435	6,562736209	33,5	87646,2701	1,24566618
Norway	122	2011	53294,03	5,43916178	2,698555181	9,169054441	56,61918623	1,6543222	0,96877971	3,7375	79,385	7,55254776	5,85992431	33,5	100575,1173	1,297189391
Norway	122	2012	52733,24	5,24561357	2,667911559	9,559613319	58,01794857	1,66552506	2,748768782	3,7875	79,665	7,379420459	5,734143206	33,5	101563,7027	1,313440989
Poland	123	1990	466371,96	0	0	7,139629462	2,501484797	0,46587059	.	.	61,27	.	0	29,5	1698,006919	0,392398205
Poland	123	1991	456203,77	0	0	7,540905857	2,06466844	0,42809716	-7,015578811	.	61,315	.	0	29,5	2192,665938	0,354679168
Poland	123	1992	442010,1	0	0	8,587257618	2,302749059	0,3784154	2,514978626	.	61,359	.	0	29,5	2411,859408	0,306681391
Poland	123	1993	442072,58	0	0	8,615537849	6,13110127	0,32776489	3,738310309	.	61,404	.	0	29,5	2449,238467	0,254450914
Poland	123	1994	438414,18	4,12059164	0	8,067689886	6,195140943	0,28426952	5,292802059	.	61,449	.	0	29,5	2819,69567	0,211012329
Poland	123	1995	441102,72	3,82693672	0	7,499549306	6,332528515	0,20729996	6,95185663	.	61,493	21,22591232	0	29,5	3612,189306	0,135721034
Poland	123	1996	454106,41	4,78904533	0	7,423803848	5,865000263	0,14922778	6,238916786	.	61,538	20,07886445	0	29,5	4066,842029	0,076074182
Poland	123	1997	445808,23	4,78137684	0	6,468646865	5,98236786	0,1385529	7,086280531	.	61,583	20,16702049	0	29,5	4076,365269	0,065455369
Poland	123	1998	416877,25	4,89346123	0	6,886792453	6,495875551	0,10717474	4,981633946	.	61,627	19,80429524	0	29,5	4483,236888	0,035753301
Poland	123	1999	406496,5	5,64003897	0	6,451111457	6,36730664	0,06469098	4,524198618	.	61,672	19,09354181	0	29,5	4351,363636	-0,008302753
Poland	123	2000	396103,65	6,00206757	0	6,199968608	6,87473501	-0,9730163	4,259803397	.	61,716	18,0684103	0	29,5	4492,758616	-1,044335398

Poland	123	2001	392886,22	5,97926617	0	7,835883639	7,236111102	0,04530203	1,2053016	.	61,761	16,55317666	0	29,5	4981,198619	-0,027587125
Poland	123	2002	380353,5	5,93461466	0	8,578637511	7,561175038	-0,0042291	1,443499193	.	61,787	16,29049651	0	29,5	5196,894709	-0,046318937
Poland	123	2003	393407,05	6,09033298	0	6,686981547	7,377630369	-0,247302	3,562532958	.	61,676	17,67114189	0	29,5	5693,407042	-0,067492702
Poland	123	2004	398043,98	6,29491138	0,086473298	6,775559589	7,31674666	-0,2402743	5,135655776	.	61,564	19,09335045	0,421863265	29,5	6639,890437	-0,058512735
Poland	123	2005	398827,04	6,13805199	2,413146687	8,234258036	7,233822527	-0,2260396	3,547057816	.	61,452	18,363321	3,28434537	29,5	7976,107862	-0,043948953
Poland	123	2006	414148,4	5,89729404	1,343690002	8,693808312	7,20867556	-0,2441598	6,2	.	61,341	18,96168649	2,06485752	29,5	8999,739627	-0,063370574
Poland	123	2007	415449,44	6,08866692	2,643359265	8,142201835	7,253424974	-0,2370582	7,156308851	.	61,229	18,77663776	4,261751623	29,5	11247,55148	-0,054305021
Poland	123	2008	406081,06	5,89148808	3,248531461	10,44776119	8,04523786	-0,171087	3,866432337	2,9625	61,116	18,56427208	5,561882538	29,5	13906,2182	0,01363738
Poland	123	2009	387700,41	6,11899567	0	10,71077629	8,944865813	-0,1156631	2,622673435	3,375	61,004	18,33278225	0	29,5	11440,57813	0,067763227
Poland	123	2010	407474,65	5,87128305	0	10,62786135	9,495260895	-0,4693734	3,709810387	3,625	60,892	17,48608109	0	29,5	12530,3071	-0,285609122
Poland	123	2011	405741,44	0	0	10,6218308	10,57978326	-0,130333	4,769475358	3,75	60,78	18,07769646	0	29,5	13776,08838	0,053769709
Poland	123	2012	399267,97	6,32648754	6,121817843	11,84586108	11,08413653	-0,1517175	1,820940819	3,15	60,688	17,95439816	8,080455676	29,5	13036,37665	-0,000239076
Portugal	124	1990	60766,81	0	3,190602856	4,504504505	26,94983636	0,88167108	3,95046264	0,71875	47,915	.	6,945372974	37	7885,389075	-0,21794848
Portugal	124	1991	62683,22	0	2,994814969	4,965243297	25,79202835	0,91909105	4,368208696	0,71875	48,469	.	7,464201931	37	8959,869242	-0,230481754
Portugal	124	1992	67105,23	0	2,307258063	4,85106383	22,4183769	1,2767936	1,089474668	0,6875	49,13	.	6,069847736	37	10811,63798	-0,077749267
Portugal	124	1993	65821,06	0	2,437184737	4,132231405	24,3759083	1,45474505	-2,043241935	0,90625	49,789	.	5,972419795	37	9535,591971	0,122316595
Portugal	124	1994	66889,55	11,5185375	1,560347138	3,96039604	24,94995877	1,58596621	0,964833458	0,90625	50,449	.	4,461871333	37	9978,299604	0,269089468
Portugal	124	1995	71398,88	11,572031	4,413495069	5,379746835	23,74587493	1,64597531	4,282787143	0,9375	51,109	18,08624736	4,924534499	37	11782,51883	0,346203938
Portugal	124	1996	69096,22	11,4491644	4,215749122	5,065666041	25,35457589	1,66101801	3,496709178	0,90625	51,77	18,87220335	4,70377461	37	12185,06673	0,375996187
Portugal	124	1997	72159,32	10,7184162	4,330990783	6,113537118	24,54726063	1,70945505	4,426181902	0,90625	52,428	18,77959854	5,719452491	37	11578,4414	0,446460605
Portugal	124	1998	77107,15	11,2125864	4,248047125	6,160220994	22,43409738	1,75264848	4,791781608	1	53,086	18,29356601	5,60991453	37	12202,69228	0,505389233
Portugal	124	1999	85223,52	10,585887	4,301308011	7,106208312	19,02748692	1,79563702	3,888230578	0,96875	53,743	17,93099196	5,153366133	37	12474,82215	0,565630442
Portugal	124	2000	84100,41	8,47967339	4,401428126	6,245407788	20,11402379	1,9161069	3,787442082	1,125	54,399	17,1678719	5,273355913	37	11502,39636	0,702859953
Portugal	124	2001	83872,45	9,29329395	3,664155224	6,57932213	20,82793439	1,88393843	1,943364651	1,25	55,044	16,7265853	5,014114947	37	11729,14426	0,705230637
Portugal	124	2002	88037,62	9,68672276	3,541268552	7,219333129	18,27982707	1,67133444	0,768763007	1,34375	55,666	16,21491192	4,851184183	37	12882,28771	0,54766794
Portugal	124	2003	82327,79	9,50799656	3,329326943	7,30318258	22,09248281	1,48482053	-0,934196273	1,90625	56,287	15,40036843	4,557181998	37	15772,73588	0,375411415
Portugal	124	2004	85298,69	9,87267494	3,871449002	7,513850416	19,86932551	1,33460087	1,811582488	1,90625	56,907	14,91151049	4,822382072	37	18045,5926	0,23912899
Portugal	124	2005	87685,99	9,48422623	3,981068972	7,476993865	18,07279609	1,26043327	0,766805995	2,3625	57,522	14,48041301	4,982834822	37	18784,95335	0,185532267
Portugal	124	2006	82647,14	8,98507023	3,411040049	7,547993019	22,33173134	1,24382847	1,553015835	2,3625	58,137	14,29303766	4,385338344	37	19821,44284	0,180332441
Portugal	124	2007	80269,39	8,68316078	3,674705138	8,791773779	23,14807899	1,24348245	2,491985613	2,1125	58,749	14,11820821	4,890384709	37	22780,05624	0,196304384
Portugal	124	2008	78031,86	7,84893036	2,203436389	9,994626545	23,18764518	1,17714752	0,199295713	2,025	59,359	13,69419877	3,271117023	37	24815,61133	0,14419128
Portugal	124	2009	74853,97	8,14592457	2,995065854	10,4375	24,89446318	1,10940421	-2,978110801	2,2	59,964	12,55862802	4,835211941	37	23063,97293	0,095330859
Portugal	124	2010	70634,19	8,16970921	3,142557661	11,23966942	27,82199	1,04647758	1,898675039	2,25	60,567	13,15142352	5,058298201	37	22539,9945	0,045910037
Portugal	124	2011	69316,55	7,23440027	2,720028546	10,9375	27,16249804	0,83869064	-1,826801401	2,04375	61,167	12,94013773	4,67994001	37	23194,74385	-0,147084879
Portugal	124	2012	68751,89	6,7713151	3,47508797	10,3626943	25,56425148	0,55613779	-4,028265295	1,94375	61,758	13,00625337	5,646911448	37	20577,40643	-0,405421788
Slovak Repub	125	1990	73226,77	0	0	.	2,225336061	1,2590436	.	.	56,491	.	0	40	2395,558976	0,439617095
Slovak Repub	125	1991	63395,54	0	0	.	2,086784747	0,58773405	.	.	56,78	.	0	40	2680,03345	0,077472437

Slovak Repub	125	1992	57780,37	0	0	.	2,318612255	-0,0750146	.	.	56,719	.	0	40	2908,800467	0,032465115
Slovak Repub	125	1993	54214,37	0	3,170493473	.	4,104216753	0,27589465	1,901265551	.	56,659	.	5,698524251	40	3089,44063	0,381719887
Slovak Repub	125	1994	51801,73	.	2,266455671	8,114856429	4,717442793	0,28630636	6,205623836	.	56,598	.	5,450224556	40	3755,728713	0,39405443
Slovak Repub	125	1995	53231,67	5,96825361	1,962335721	7,605985037	4,207009663	0,18479793	5,84334694	.	56,537	25,67153238	2,675830737	40	4799,156415	0,292632207
Slovak Repub	125	1996	53658,4	5,54116297	2,42981694	5,368731563	3,905504406	0,10372275	6,757140098	.	56,476	24,40816601	5,644806558	40	5177,751223	0,211674396
Slovak Repub	125	1997	52560,77	5,63659573	1,988938324	6,715063521	3,853385628	0,07833067	6,060340514	.	56,416	22,27038258	5,143954477	40	5137,809021	0,184629991
Slovak Repub	125	1998	51859,38	5,382936	1,564946588	5,747126437	3,630587749	0,02594298	3,994157751	.	56,355	22,79290628	5,308163292	40	5532,270407	0,134121598
Slovak Repub	125	1999	50809,84	5,74210119	1,447906129	5,885959534	3,797944622	-0,0062547	-0,201699711	.	56,294	20,7209507	3,279959714	40	5635,452319	0,102053161
Slovak Repub	125	2000	48947,36	6,72492647	1,334535025	5,321219987	3,728089807	-0,2437758	1,21315778	.	56,233	23,90795416	2,876380437	40	5402,043094	-0,135376488
Slovak Repub	125	2001	51478,96	6,07038021	1,867359707	5,240488155	6,000999908	-0,307577	3,323344861	.	56,163	24,8155494	4,114177829	40	5707,513359	-0,183012271
Slovak Repub	125	2002	49919,34	6,73459005	2,689546617	7,098381071	5,481049183	-0,3037778	4,714416567	.	56,013	22,36776114	5,150263405	40	6536,231078	-0,036352551
Slovak Repub	125	2003	50670,53	7,53484774	1,623494488	11,84834123	5,346865237	-0,3339823	5,411369622	1	55,863	22,97129572	2,560202905	40	8711,648972	-0,065821507
Slovak Repub	125	2004	50933,1	8,05744743	2,744054408	8,333333333	6,247302524	-0,2892516	5,241472596	1	55,713	23,52391314	4,752669362	40	10671,33536	-0,02036172
Slovak Repub	125	2005	50263,74	7,72457027	1,03275653	6,936416185	6,306465311	-0,2597708	6,538393242	1,33125	55,563	23,55686815	2,642726051	40	11665,50981	0,009809134
Slovak Repub	125	2006	50317,6	7,98322296	3,948665114	11,97916667	6,567616741	-0,267534	8,259223544	1,33125	55,412	23,47728037	6,566513025	40	13111,77166	0,004597119
Slovak Repub	125	2007	48395,32	7,40565205	4,30094901	13,63636364	8,246931355	-0,2437038	10,68113129	1,05	55,261	23,28609983	6,691131755	40	16006,88076	0,029178401
Slovak Repub	125	2008	49001,04	7,031672	2,960446006	8,75	7,629428361	-0,1860609	5,446741427	1,4	55,111	22,26100806	5,047435496	40	18558,88684	0,0857553
Slovak Repub	125	2009	44690,17	6,76154041	2,348833731	13,01775148	9,999139247	-0,141099	-5,290243351	2,11875	54,96	17,71205401	4,007833452	40	16455,16583	0,133257321
Slovak Repub	125	2010	45382,46	6,67122269	2,08343842	14,60176991	10,27964556	-0,4084511	4,827314045	2,05625	54,685	20,79559598	3,623844425	40	16509,89692	0,093191273
Slovak Repub	125	2011	44697,89	6,50733995	2,122668718	17,08542714	10,35755146	-0,3751897	2,704198974	3,55625	54,41	21,09797111	4,179484714	40	18065,67259	0,128936463
Slovak Repub	125	2012	42710,2	6,24040604	2,999668895	9,036144578	10,48083566	-0,2848199	1,602037893	3,50625	54,163	20,88021295	3,622192613	40	17151,37028	0,170183855
Slovenia	126	1990	18444,42	0	0	.	12,35194813	0,40881166	.	.	50,38	.	0	60	.	0,090624343
Slovenia	126	1991	17320,7	0	0	.	13,13077963	0,3151958	.	.	50,507	.	0	60	.	0,063438224
Slovenia	126	1992	17208,76	0	0	.	13,90084128	-0,0933245	.	.	50,534	.	0	60	.	-0,146699403
Slovenia	126	1993	17450,39	0	0	4,882459313	12,35673491	-0,1848254	.	.	50,561	.	0	60	.	-0,238300478
Slovenia	126	1994	17640,88	.	0	7,347972973	12,33609747	-0,0603928	.	.	50,589	.	0	60	.	-0,115694093
Slovenia	126	1995	18548,59	0,75922167	0	4,186602871	11,49481989	0,07498884	.	.	50,616	25,30007342	0	60	10690,71278	0,0215615
Slovenia	126	1996	19224,38	0,71614087	1,03076982	4,072134962	11,09418051	-0,009234	3,516450347	.	50,643	25,37301568	1,568804947	60	10801,41329	-0,062536134
Slovenia	126	1997	19585,6	1,42345488	1,779682243	3,58265242	10,23270199	-0,0791694	5,11444817	.	50,671	25,62195995	3,015378362	60	10447,91508	-0,134454343
Slovenia	126	1998	19345,12	2,41207552	1,879030102	4,510451045	11,0884498	-0,1648972	3,285805431	.	50,698	25,77267881	2,84407799	60	11165,31142	-0,218117657
Slovenia	126	1999	18693,85	6,71584558	1,601164483	4,319437469	10,95033425	0,12474225	5,273924468	.	50,725	25,54865954	2,48404434	60	11442,02282	0,071430845
Slovenia	126	2000	18953,36	9,35667992	1,489982538	3,458646617	15,86476704	0,34922547	4,155487429	.	50,752	24,93403702	2,449296179	60	10227,75111	0,29607496
Slovenia	126	2001	19819,74	9,92518044	2,49336413	2,718243596	14,99182521	0,21266844	2,9495093	.	50,78	25,04551368	3,220510502	60	10479,31264	0,157498742
Slovenia	126	2002	19977,38	9,97261715	1,602827671	4,630650496	14,09608674	0,11796497	3,836133571	.	50,777	24,75753321	2,166919137	60	11814,10709	0,123915442
Slovenia	126	2003	19672,15	9,92899799	1,9922407	5,9	14,18373225	-0,1210296	2,842412786	.	50,685	24,84227951	2,860176135	60	14880,46899	0,060296779
Slovenia	126	2004	19980,12	9,89262199	1,22012617	4,676454595	15,41054996	-0,117613	4,351684751	.	50,593	24,48690828	1,899540661	60	17260,90239	0,064066202
Slovenia	126	2005	20313,71	9,29563808	3,13482153	5,026537621	14,56625131	-0,0088092	4,002960675	.	50,501	23,56654044	3,599837171	60	18169,17979	0,173208905

Slovenia	126	2006	20526,18	8,65114689	1,563447365	4,781144781	14,41437584	0,13680197	5,656148851	.	50,409	23,43101499	2,436227442	60	19726,13825	0,319114537
Slovenia	126	2007	20671,8	8,63316822	1,364414178	6,257521059	14,11952353	0,37649889	6,941453447	.	50,317	23,31323729	2,432933665	60	23841,32389	0,559207816
Slovenia	126	2008	21384,37	8,69196033	3,509728616	6,327944573	13,89825909	-0,0267895	3,300104169	.	50,224	21,94522871	4,621092495	60	27501,81752	0,158140844
Slovenia	126	2009	19373,15	9,95488358	2,269026279	6,764866339	17,92267948	0,72247267	-7,79732067	.	50,133	19,55998914	3,85133606	60	24633,79608	0,903875535
Slovenia	126	2010	19411,38	10,2203484	3,268784025	6,142034549	18,05105938	0,25043258	1,221819153	.	50,04	20,16070813	5,261098296	60	23417,64045	0,436079485
Slovenia	126	2011	19462,56	10,0565071	3,356460533	7,466063348	17,7199138	0,02370194	0,612801297	.	49,948	20,96201585	6,949651656	60	24964,80172	0,207732702
Slovenia	126	2012	18910,98	11,0608501	2,980598905	6,804123711	19,32173471	0,02564639	-2,639506751	.	49,856	21,63726389	5,770903318	60	22488,65889	0,210024306
Spain	127	1990	283749,23	0	4,293082397	6,113373003	10,54443155	0,45093024	3,781400803	0,5	75,351	.	6,782061393	35,5	13773,36465	0,151881923
Spain	127	1991	293164,79	0	3,592309582	6,825864921	9,921294188	0,46245677	2,545990065	0,65625	75,528	.	5,951864404	35,5	14782,03946	0,22783038
Spain	127	1992	301709,76	0	1,947764941	6,939163498	8,22090807	0,43847119	0,92922876	0,65625	75,61	.	3,917944914	35,5	16105,41741	0,329961303
Spain	127	1993	291118,16	0	2,256544554	6,865970534	9,079810363	0,41930482	-1,031504539	0,71875	75,692	.	4,285077624	35,5	13362,01873	0,310911158
Spain	127	1994	307473,16	6,73688841	2,382706447	6,705479452	9,241374492	0,3772872	2,383200292	1,03125	75,774	.	4,239446332	35,5	13465,3784	0,269014245
Spain	127	1995	322108,19	6,73659658	2,62006981	6,826691629	8,264565557	0,34214027	2,757497697	1,03125	75,856	17,61650956	5,285825726	35,5	15561,97275	0,233979972
Spain	127	1996	314841,92	6,74277592	2,670845368	6,175928364	10,06199044	0,33924247	2,67472166	1,125	75,938	17,73761669	5,232948391	35,5	16236,77168	0,231202196
Spain	127	1997	328188,89	6,57753277	2,160677741	6,495584283	9,154293636	0,37027399	3,689611652	1,125	76,019	18,13650718	6,518095017	35,5	14872,56589	0,263663726
Spain	127	1998	338022,05	6,91302395	2,557107789	6,039496002	8,941413754	0,45627649	4,305954242	1,25	76,1	18,14234909	6,03845799	35,5	15534,35989	0,34978306
Spain	127	1999	364001,49	6,82458115	2,578907801	6,374115499	7,681656664	0,62155408	4,484868682	1,5	76,181	17,95753872	6,366545641	35,5	15859,08603	0,515171909
Spain	127	2000	380004,18	6,54118395	4,014075407	6,758172096	7,884333609	0,94665514	5,289101181	1,59375	76,262	17,84125078	7,117327988	35,5	14787,75606	0,840384465
Spain	127	2001	376963,35	6,31190777	3,687377186	6,875637683	8,933449936	1,32263572	4,001084229	1,625	76,343	17,40543698	4,790927653	35,5	15359,10844	1,216479485
Spain	127	2002	394905,23	6,19815159	1,729665294	6,876181474	7,415105669	1,89254303	2,879800598	1,625	76,533	16,87652041	3,063123341	35,5	17019,53541	1,643976833
Spain	127	2003	402420,16	6,28389645	1,88108644	7,188703466	8,899924141	2,12806716	3,187555487	2,375	76,778	16,45849509	3,555095218	35,5	21495,70741	1,808454468
Spain	127	2004	417194,61	5,99540329	4,080163328	7,680741762	8,033365014	2,0427621	3,166754693	2,9375	77,022	16,05592939	7,050931929	35,5	24918,64584	1,725466303
Spain	127	2005	431392,66	5,63715935	4,601695913	7,9250916	7,291614203	2,00175762	3,723042003	3,1125	77,263	15,73251088	6,83668189	35,5	26510,71745	1,689349047
Spain	127	2006	423788,78	5,27954674	4,280968733	8,89166728	8,475743174	1,9992081	4,174126284	3,1125	77,502	15,51208099	6,584361915	35,5	28482,60948	1,690352556
Spain	127	2007	432111,64	5,09491825	5,261455782	9,294585599	9,005904599	2,15770109	3,768945822	2,95625	77,74	14,97067908	8,287401011	35,5	32709,40104	1,851081308
Spain	127	2008	398444,15	5,1872654	5,290715035	10,61414072	9,741602632	1,89844652	1,115925266	2,91875	77,976	14,50171205	9,1115236	35,5	35578,73619	1,595330499
Spain	127	2009	359659,15	5,49691725	5,51656424	11,96648595	12,22508053	1,1853779	-3,573794025	3,15625	78,21	13,17007281	8,843063152	35,5	32333,4661	0,885735981
Spain	127	2010	347181	5,2815876	4,234996788	12,04318937	14,40338927	0,75660789	0,013804783	2,95	78,442	13,27753045	7,706897139	35,5	30737,83227	0,460408305
Spain	127	2011	345887,15	5,11983013	4,559431431	12,03749383	14,74976708	0,64938946	-0,617622686	3,85625	78,673	13,46387848	8,431311986	35,5	31973,01908	0,355338396
Spain	127	2012	340808,59	4,94172907	3,774957052	11,6567728	15,74527793	0,35558183	-2,088745234	2,75625	78,902	13,06277034	6,164872997	35,5	28985,33333	0,064925963
Sweden	128	1990	72713,85	0	3,223044786	6,53381248	34,06198948	0,77260548	0,754672078	0,875	83,1	21,04661196	6,659337956	68,5	30162,31625	0,772602676
Sweden	128	1991	72884,06	0	3,14048599	7,540861813	32,45879318	0,80671793	-1,145974204	0,65625	83,204	19,51063202	5,916309501	68,5	31374,11682	0,681643118
Sweden	128	1992	72412,49	0	3,579918176	8,373293987	33,23216365	0,77503613	-1,158593658	1,59375	83,361	18,37352118	5,968356856	68,5	32338,50429	0,586529929
Sweden	128	1993	72442,83	0	3,393892763	8,369312521	34,38515585	0,76660347	-2,065613434	0,90625	83,516	18,86528625	5,551708291	68,5	24080,89967	0,580838814
Sweden	128	1994	74898,45	6,21808815	3,758161957	8,343711083	31,3544226	0,89613016	4,087603253	1,1875	83,671	20,58684228	6,169933545	68,5	25747,24169	0,710705462
Sweden	128	1995	74151,76	6,0345335	2,344490922	7,518993974	33,91417917	0,70739335	4,024303169	0,9375	83,824	22,76516425	5,158851445	68,5	29914,33175	0,524703942
Sweden	128	1996	78017,33	6,50056601	2,344451055	6,104883907	31,35609935	0,26646116	1,51786036	0,6875	83,914	22,02128318	5,158848037	68,5	32587,2641	0,159147081

Sweden	128	1997	72928,08	5,94516993	0	5,438358816	35,62061036	0,09062006	2,90048313	0,6875	83,942	22,39623983	0	68,5	29897,79263	0,057262203
Sweden	128	1998	73396,87	6,01843405	0,846489726	5,185633575	35,65790185	0,08886961	4,226791612	0,96875	83,97	22,76562937	5,183340754	68,5	30143,62746	0,055512122
Sweden	128	1999	70050,09	5,70559502	1,599613846	5,273287144	34,79224778	0,11126502	4,530153946	0,9375	83,998	22,49515555	7,511033402	68,5	30577,08177	0,077927151
Sweden	128	2000	68562,87	5,4500246	1,365886273	4,728312679	40,00826206	0,19389995	4,73528882	1,875	84,026	22,98123803	7,13295259	68,5	29283,00505	0,160575485
Sweden	128	2001	69344,23	5,74853086	0,940587654	4,707825728	37,66157802	0,32202144	1,563407818	2,625	84,071	21,90183112	4,023635189	68,5	26969,24457	0,268470528
Sweden	128	2002	70067,57	6,10032368	0,994896056	5,018007203	36,14876435	0,39915296	2,073577943	3,0625	84,133	21,32294826	3,496179722	68,5	29571,70446	0,325438068
Sweden	128	2003	70469,96	6,06474209	1,518212577	4,718456726	34,91042916	0,44693873	2,385742815	3,0125	84,196	20,83573938	4,455729147	68,5	36961,42537	0,372092943
Sweden	128	2004	69698,88	5,89782047	1,817956367	6,638772664	35,82330934	0,46691146	4,32052663	3,3125	84,258	20,6727949	4,789983947	68,5	42442,22045	0,393298991
Sweden	128	2005	66912,77	5,86132669	2,208298833	9,508644222	39,9918932	0,47232031	2,818331148	2,925	84,319	20,54695198	4,530168447	68,5	43085,35315	0,399942763
Sweden	128	2006	66778,43	5,68142128	1,752271021	8,939264328	41,12659026	0,69403298	4,688128579	3,225	84,43	20,58713789	5,313735745	68,5	46256,4716	0,562483906
Sweden	128	2007	65232,81	5,65001154	1,392549475	10,57192374	42,92465794	0,92851896	3,404948607	2,975	84,588	20,5369465	4,780821607	68,5	53324,37937	0,741552515
Sweden	128	2008	63013,87	5,8636241	1,465175223	11,46077971	44,86558742	0,96565305	-0,557047987	3,39375	84,746	19,06735575	5,005069822	68,5	55746,84238	0,779033291
Sweden	128	2009	59097,38	6,15781307	1,848558204	12,73426237	47,0773657	1,0358066	-5,184660922	3,7875	84,902	17,31046459	6,097567132	68,5	46207,0592	0,851904413
Sweden	128	2010	65071,97	6,02478409	1,762289522	13,65079365	45,97780629	1,0337504	5,988927133	3,5375	85,056	18,58799976	6,520473564	68,5	52076,43052	0,852524629
Sweden	128	2011	60754,24	5,76070452	1,943055209	12,5	46,54413956	0,9360368	2,664408163	3,70625	85,21	18,26139002	7,202766819	68,5	59593,6848	0,755150134
Sweden	128	2012	57604,15	5,67373991	1,93744794	11,34831461	49,91317194	0,91916079	-0,286319956	3,60625	85,363	17,18845412	6,867705955	68,5	57134,07707	0,739763272
Switzerland	129	1990	52889,94	0	2,312123439	4,726598703	16,7806974	3,0977975	3,674624439	1,9375	73,184	20,66861546	4,624391929	30	38332,1548	1,026873072
Switzerland	129	1991	54607,28	0	0	6,00814664	17,20482517	2,0622821	-0,915805538	2,375	73,781	20,49078713	0	30	38303,05074	1,249826024
Switzerland	129	1992	54370,31	0	1,052656279	6,571741512	17,01770459	1,03337149	-0,043737004	2,25	73,73	20,11987149	1,403509521	30	39435,54023	1,102521072
Switzerland	129	1993	51594,95	0	0	6,359102244	18,12002403	0,84151264	-0,125980016	2,3125	73,679	19,89712046	0	30	38005,32055	0,910715566
Switzerland	129	1994	50760,13	7,30286503	1,890002255	6,032786885	18,46533353	0,72927248	1,269754995	2,3125	73,629	20,24879641	3,264586424	30	41738,9696	0,797158411
Switzerland	129	1995	51575,62	7,15058804	0	6,153846154	17,88679129	0,59896453	0,480872078	2,3125	73,578	19,8078246	0	30	48540,57355	0,668242326
Switzerland	129	1996	52232,84	7,11312771	1,374592204	5,986903648	16,8997935	0,37228914	0,6010826	2,3125	73,527	19,51437251	2,40551433	30	46610,0577	0,441636407
Switzerland	129	1997	51318,61	6,88416767	0	5,882352941	17,66151442	0,17151595	2,312045481	2,3125	73,476	19,63098488	0	30	40429,9352	0,24089121
Switzerland	129	1998	52663,38	7,05154753	0,373118365	4,068522484	17,23449479	0,22632852	2,944785248	2,3125	73,424	19,22378722	1,119421575	30	41487,68954	0,297135766
Switzerland	129	1999	52679,67	7,24797964	0	6,402439024	18,60069674	0,40744802	1,64336715	2,3125	73,373	18,99448691	0	30	40577,33322	0,476919931
Switzerland	129	2000	51774,81	6,91024876	0,18518582	4,60593654	18,42482763	0,49241745	3,946098963	2,375	73,322	18,46646699	1,112073192	30	37813,23022	0,561954617
Switzerland	129	2001	52804,53	7,28673601	0	4,656084656	19,1536001	0,63277565	1,446599189	3,125	73,322	19,18004882	0	30	38538,64307	0,632771238
Switzerland	129	2002	51710,22	7,19208002	0,337828741	4,324894515	18,46012422	0,80827715	0,143400521	3,125	73,36	19,58668001	1,062936407	30	41336,72164	0,756469146
Switzerland	129	2003	52835,35	7,35323858	0	5,283757339	18,32077252	0,79370266	0,049702558	3,125	73,398	19,38491431	0	30	47960,5636	0,741919603
Switzerland	129	2004	53503,19	7,30750322	0,295881776	6,161616162	18,39585251	0,73918396	2,84295634	2,625	73,436	19,4631843	0,929356821	30	53255,9767	0,68742596
Switzerland	129	2005	54209,49	7,43974113	0	6,350806452	19,04890613	0,69233646	3,03829565	2,65625	73,474	19,60180184	0	30	54797,54675	0,64060154
Switzerland	129	2006	53845,81	7,10683346	0,142432921	7,270916335	18,43249672	0,67926975	4,012782006	2,15625	73,512	19,96619127	1,059440497	30	57348,92444	0,627558473
Switzerland	129	2007	51910,3	6,88707113	0	7,649667406	19,7045638	0,94536994	4,140354374	2,15625	73,55	20,12698455	0	30	63223,46492	0,893690978
Switzerland	129	2008	53653,05	6,80681276	0,360585469	11,09433962	19,98999127	1,32226082	2,277231127	2,75	73,588	20,41487585	1,048502195	30	72119,55903	1,270618074
Switzerland	129	2009	52366,48	6,68212652	0	9,884778654	20,52468854	1,29976081	-2,129604826	3,28125	73,625	19,08262645	0	30	69672,00863	1,249484631
Switzerland	129	2010	54095,22	7,01713181	0,323280349	12,69935027	21,20090656	1,09315509	2,953806584	3,59375	73,663	19,19194321	1,035210418	30	74277,1216	1,041558058

Switzerland	129	2011	49973,23	6,73239374	0	11,11111111	21,31070784	1,16343929	1,804553114	3,75	73,701	19,50869374	0	30	88002,61459	1,111878943
Switzerland	129	2012	51449,02	6,75737953	0,183653481	9,213483146	22,68294717	1,11336779	1,109171726	3,75	73,739	19,00765996	0,711636747	30	83295,25862	1,061819329
Turkey	130	1990	188434,23	0	0	6,338028169	24,57491978	3,9609086	9,26614667	0,78125	59,203	22,73261598	0	14	2790,580487	1,733698988
Turkey	130	1991	200654	0	0	7,379518072	24,25282578	2,97746675	0,720279047	0,53125	59,976	22,98182184	0	14	2750,730314	1,680238697
Turkey	130	1992	211729,35	0	0	5,701754386	24,28564319	2,52832048	5,035634937	0,78125	60,518	22,47393495	0	14	2850,59697	1,62868624
Turkey	130	1993	223080,22	0	0	7,109004739	23,88432095	2,47665393	7,651265191	0,78125	61,055	21,6984203	0	14	3181,633364	1,59322824
Turkey	130	1994	218530,04	6,78219652	0	6,500956023	24,30662779	2,44935582	-4,668147359	0,78125	61,59	22,86616583	0	14	2268,581235	1,576912976
Turkey	130	1995	238820,28	7,22903585	0	4,405286344	22,14953398	2,43501944	7,878266876	0,8125	62,123	23,42343594	0	14	2896,090604	1,573342423
Turkey	130	1996	259939,01	9,55389118	0	4,902506964	21,28914404	2,42477088	7,379664476	0,8125	62,653	21,8187686	0	14	3052,498119	1,575243233
Turkey	130	1997	273172,46	10,5834131	0	5,909510619	20,88750189	2,40912291	7,577663648	0,8125	63,179	22,31788461	0	14	3143,264599	1,573083202
Turkey	130	1998	275193,34	9,69533062	0	6,090534979	21,68018745	2,38798167	2,308213489	0,8125	63,703	25,74108085	0	14	4389,724574	1,562013
Turkey	130	1999	275905,57	21,4976368	0	6,434641845	20,58896585	2,35092002	-3,365343997	0,8125	64,223	23,778381	0	14	4009,133896	1,53794559
Turkey	130	2000	298090,87	19,5752258	0	5,099009901	17,28649409	2,30817191	6,774455335	0,59375	64,741	22,25388158	0	14	4215,162413	1,504842476
Turkey	130	2001	279074,9	20,0726299	0	5,183585313	18,13134076	2,38813925	-5,697476493	0,59375	65,332	21,27490277	0	14	3053,865108	1,479411555
Turkey	130	2002	287052,04	22,1257191	0	2,947368421	17,48360525	2,40470375	6,163839607	0,625	65,953	20,07653749	0	14	3570,546263	1,458665151
Turkey	130	2003	303537,09	16,8103256	0	7,282913165	16,30549614	2,35416379	5,265265304	0,625	66,569	20,18473078	0	14	4586,811203	1,424498963
Turkey	130	2004	313071,02	15,151701	0	7,989690722	16,80231677	2,2869251	9,362807614	0,8125	67,18	19,84402204	0	14	5855,53866	1,373267794
Turkey	130	2005	330740,34	16,9486561	0	6,732673267	15,32417298	2,20937696	8,401617872	0,96875	67,783	19,75402671	0	14	7117,322711	1,315792199
Turkey	130	2006	350881,15	15,1527443	0	4,180602007	14,26796791	2,11602642	6,893489337	1,03125	68,382	19,34862856	0	14	7727,272405	1,236206437
Turkey	130	2007	382378,4	15,0231981	0	5,752212389	12,50246954	2,03662212	4,668579412	1,03125	68,975	18,64876873	0	14	9309,509482	1,173171827
Turkey	130	2008	368734,42	14,0406942	1,956315471	5,172413793	12,4369677	2,03272537	0,658838445	1,0625	69,562	17,84674749	4,387231556	14	10382,31817	1,185293292
Turkey	130	2009	371149,35	14,327364	1,450444331	5,589123867	13,35224753	2,12399801	-4,825875213	1,09375	70,141	16,61619961	3,352529402	14	8623,949625	1,295093417
Turkey	130	2010	403494,7	15,0286875	1,490001275	3,734939759	14,35194476	2,27649098	9,156952903	.	70,715	17,41421361	3,917381977	14	10111,51771	1,461468388
Turkey	130	2011	424090,95	15,4845419	2,030177804	.	12,79332161	2,02047701	8,772747615	.	71,282	18,18112878	4,184217721	14	10584,16396	1,221865652
Turkey	130	2012	439873,73	16,7672367	1,781140337	5,602240896	12,83503498	1,99327068	2,127460619	.	71,834	17,3907607	4,001641285	14	10646,03553	1,221863657
United Kingd	131	1990	778805,3	0	1,416734107	5,305728255	0,653010477	0,23496471	0,537079439	0,65625	78,14	18,85181712	4,276433975	12,5	19095,467	0,298930554
United Kingd	131	1991	786300,13	0	1,430160558	5,629759081	0,610399487	0,27340874	-1,236323476	0,65625	78,112	18,49598959	4,075663318	12,5	19900,72665	0,309247932
United Kingd	131	1992	762457,67	0	1,368494273	5,452102131	0,843333112	0,34721379	0,446962006	0,65625	78,172	18,14569683	3,730189433	12,5	20487,17079	0,270431182
United Kingd	131	1993	743586,13	0	2,011552044	5,611118327	0,777487859	0,31646926	2,645589046	0,71875	78,232	17,67567935	3,80338469	12,5	18389,01957	0,239745439
United Kingd	131	1994	733508,83	8,39310646	2,253667023	5,397708458	1,023140655	0,33253013	4,02496297	0,75	78,293	18,38261682	3,320903629	12,5	19709,2381	0,254586487
United Kingd	131	1995	726758,05	8,4684515	2,336054818	5,782755926	1,061995852	0,34115361	2,530400318	0,75	78,353	18,80092834	3,263034946	12,5	21295,89728	0,264547417
United Kingd	131	1996	748199,17	8,57497692	2,211115169	4,80958231	0,947082423	0,33117375	2,666815554	0,75	78,413	18,50214599	2,953301416	12,5	22426,94555	0,254626384
United Kingd	131	1997	723818,76	8,37346554	2,260893699	5,182560653	1,031351402	0,33276626	2,552642411	0,75	78,472	18,37940147	2,941601686	12,5	24670,97448	0,257553323
United Kingd	131	1998	722987,22	8,66367149	2,448013678	5,330903292	1,028375123	0,36783851	3,510761771	0,75	78,532	17,41492074	2,928015441	12,5	26144,87153	0,291406085
United Kingd	131	1999	692181,89	8,64519024	2,323595437	5,397416247	0,949134008	0,40850567	3,15118968	0,75	78,591	16,3294739	2,781338818	12,5	26555,07736	0,333405882
United Kingd	131	2000	693693,37	8,21175194	2,260200259	4,872524231	0,96199124	0,43361566	3,768864546	0,875	78,651	15,66480994	2,73728232	12,5	26296,44819	0,357300887
United Kingd	131	2001	699212,55	7,63880205	1,911391611	5,220517223	0,873117635	0,51204026	2,664535041	0,875	78,751	14,54448135	2,455730509	12,5	25864,39497	0,38497597

United Kingd	131	2002	680632,45	7,79273129	1,59529224	5,656993805	0,995871057	0,79850102	2,452281678	1	79,047	13,65018898	2,103151831	12,5	28202,85426	0,42333708
United Kingd	131	2003	687042,24	7,69437313	1,82971776	6,414757844	0,968749374	0,83435975	4,300444053	1,6125	79,339	12,78036394	2,176139249	12,5	32586,6428	0,465641114
United Kingd	131	2004	684160,99	7,44904089	1,757666711	6,345909773	1,169848291	0,93379733	2,453888755	1,6125	79,629	12,13591023	2,171651135	12,5	38308,43637	0,568943113
United Kingd	131	2005	678252,8	6,98031521	1,839371039	6,689834926	1,412878649	1,04513368	2,806547611	2	79,915	11,81199996	2,078477625	12,5	39934,7836	0,686611306
United Kingd	131	2006	675547,22	6,56597376	1,763333158	7,708372888	1,61004036	1,08979547	3,042098201	2,04375	80,199	11,29722366	2,237867464	12,5	42446,79557	0,735048678
United Kingd	131	2007	666079,29	6,78429079	1,911348718	8,711093891	1,900271376	1,12718996	2,555635137	1,76875	80,479	10,70286676	2,509583681	12,5	48319,93195	0,778666112
United Kingd	131	2008	646736	6,72725821	2,816553585	10,59362604	2,53771883	1,1318692	-0,332043634	1,96875	80,757	10,66005601	3,568067275	12,5	45167,73523	0,787032622
United Kingd	131	2009	593379,87	7,44115305	3,018536584	10,92505164	3,095516086	1,09510527	-4,310615794	2,1375	81,031	10,11978432	3,608248857	12,5	37076,64525	0,75639086
United Kingd	131	2010	609147,47	7,33248997	2,991967754	11,45936855	3,231317742	1,11777109	1,911377665	2,89375	81,302	10,31290422	3,795033744	12,5	38362,21712	0,783888647
United Kingd	131	2011	566268,75	6,99774599	3,012204718	11,04565538	4,107318765	1,11076971	1,645120728	2,78125	81,57	10,31774131	4,023228941	12,5	40974,70814	0,781677289
United Kingd	131	2012	584304,29	6,96814871	2,797857807	10,7194662	4,350695632	1,01844338	0,659035023	2,65	81,834	10,28647656	3,977637617	12,5	41050,77194	0,695315843
United States	132	1990	6219524,02	0	0,617738825	5,248722611	4,175462722	1,41025629	1,919329365	1,25	75,3	.	4,891738919	30	23954,4433	1,12965052
United States	132	1991	6195074,54	0	0,667708697	5,547238602	4,50791994	1,8673844	-0,07403686	1,28125	75,701	.	5,148944565	30	24405,19248	1,336260741
United States	132	1992	6295803,99	0	0,712009123	5,636720878	4,76308357	1,908633	3,555380611	1,28125	76,097	.	5,321793035	30	25492,95555	1,386885692
United States	132	1993	6430339,4	0	0,728349837	5,608100394	4,281528815	1,83118228	2,7457867	1,40625	76,488	.	4,558983458	30	26464,82173	1,31868
United States	132	1994	6499923,37	4,10424948	0,809295927	5,360038736	4,088640895	1,73098223	4,037706218	1,40625	76,875	.	5,013829741	30	27776,61653	1,226296089
United States	132	1995	6597665,21	4,02631474	0,798069515	5,204159067	4,726553427	1,68646666	2,719014088	1,53125	77,257	.	4,932331264	30	28782,17502	1,190787091
United States	132	1996	6812323,32	3,57828569	0,698055004	4,992769514	4,763930419	1,65278298	3,795863813	1,5	77,636	.	4,349085432	30	30068,22721	1,16341162
United States	132	1997	6867121,18	3,56760192	0,795497407	4,866213697	4,514259885	1,68197527	4,486988633	1,53125	78,008	16,80343123	4,105609566	30	31572,69023	1,203960297
United States	132	1998	6868760,62	3,55205345	0,77628107	4,828965071	4,534296436	1,63762766	4,449910962	1,5625	78,377	16,41964587	2,064754047	30	32949,19776	1,165714526
United States	132	1999	6930957,16	3,54184699	0,712030671	4,830857719	5,709727338	1,61295677	4,68519975	1,5625	78,742	16,06174719	2,169426591	30	34620,9289	1,148340047
United States	132	2000	7075609,42	3,3936646	0,642009269	5,197352701	5,429623376	1,51201139	4,092176435	1,53125	79,057	15,68604526	1,875317686	30	36449,85512	1,112768997
United States	132	2001	6979196,38	3,38672662	0,626741044	5,080309072	4,678571016	1,21338042	0,975981897	1,53125	79,234	14,38195228	2,069561218	30	37273,6181	0,989741382
United States	132	2002	7011195,7	3,62935805	0,574297216	5,268447313	4,844042701	1,14841885	1,786127404	1,58125	79,409	13,87754573	1,866498943	30	38166,03784	0,927797486
United States	132	2003	7057538,8	3,62073493	0,493705279	5,365837122	5,332035999	1,07836038	2,8067755	1,58125	79,583	13,76655886	1,714779208	30	39677,19835	0,859481713
United States	132	2004	7198378,99	3,51224542	0,524192111	5,695841385	5,485472011	1,1438853	3,785743356	1,58125	79,757	13,67309941	1,608768477	30	41921,80976	0,925483969
United States	132	2005	7228293,16	3,29681611	0,48827128	6,063819843	5,850952186	1,13588459	3,345215888	1,6125	79,928	13,48896646	1,496964018	30	44307,92058	0,921713167
United States	132	2006	7150743,56	3,15361714	0,45692146	6,255230845	6,410952155	1,17796816	2,666625986	2,4875	80,099	13,52231172	1,37149957	30	46437,06712	0,964253917
United States	132	2007	7287750,12	3,03159332	0,519767736	6,675926358	6,323653221	1,16306776	1,778570372	2,45625	80,269	13,2918886	1,874335314	30	48061,53766	0,951055243
United States	132	2008	7090753,13	3,08107829	0,37952504	7,398463139	6,878846523	1,15618567	-0,291621579	2,50625	80,438	12,73240114	1,817287781	30	48401,42734	0,945865287
United States	132	2009	6642319,59	3,36760688	0,343899886	8,100095872	7,408772471	1,08529029	-2,775529444	3,225	80,606	12,25852708	2,653202834	30	47001,55535	0,876651299
United States	132	2010	6854728,19	3,30721855	0,402115976	8,779442331	7,478927785	1,04178246	2,53192038	2,9125	80,772	12,54775257	2,127388193	30	48374,05646	0,836054312
United States	132	2011	6716993,02	3,26958609	0,404490958	8,89176997	8,185442547	0,97245444	1,601454273	2,63125	80,94	12,6139194	1,973278662	30	49781,35749	0,764677599
United States	132	2012	6487847,05	3,1474843	0,395861887	8,232673347	7,918396428	0,97127334	2,321084741	3,19375	81,108	12,67237858	1,948002254	30	51456,65873	0,76392741

Appendix E

Raw numbers from SSB for construction of figure 11 and 13.

Raw data figure 11

	1990	1991	1992	1993	1994	1995	1996	1997	1998
GHG, all	51913	49578	47769	49798	51700	51406	54404	54329	54493
	1999	2000	2001	2002	2003	2004	2005	2006	2007
	55470	54877	56139	55055	55661	56205	55281	55060	56949
	2008	2009	2010	2011	2012	2013	2014	2015	
	55422	52682	55280	54288	53848	53576	53166	53944	

Raw data figure 12

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CO2-tax reven	2656	2911	3158	3403	6812	6769	6584	6552	5676	8510
Taxes on all ty	2656	2911	3158	3403	6812	6769	6584	6552	5737	8633
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
-	7316	7739	8432	6707	6575	6889	6901	6629	9300	9910
	7483	7915	8654	13830	11214	12579	12285	11929	13615	14194