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Carbon Tax: A Political Tool or an Impactful Environmental Policy?

Marisa Lewis

Abstract

Many European states have introduced carbon tax regimes into their national policies, as a way to combat the growing concerns of global warming and climate change. This paper explores the impact of national carbon tax regime in European states on the amount of carbon dioxide that is produced. It does this by comparing carbon tax regimes in Norway, Sweden, and France, in order to understand how each of these regimes works within their respective state and establishes national limitations on the amount of carbon dioxide that is produced. This paper then goes into an analysis of the amount of carbon dioxide produced per capita by all 27 EU member states and Norway, and then compares this average to the carbon dioxide per capita rates of the three case studies, in order to see if the establishment of a carbon tax regime has a direct impact on decreasing the pollution of carbon dioxide. This paper finds that although there are some indications that the establishment of a carbon tax may decrease national carbon dioxide per capita, due to the multisource nature of carbon dioxide emissions, carbon taxes cannot be found to have a direct link to the amount of carbon dioxide per capita that is emitted by a state.

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Introduction:

Energy usage and greenhouse gas (GHG) emissions are of high importance to not only the European Union (EU) but also the individual member states. Following the signing of the Paris Climate Agreement in 2016 by all EU member states, there was increased political and social pressure to reduce the amount of carbon dioxide that was emitted. While this international agreement brought the issue of carbon emissions and climate change to the forefront of energy policy worldwide, many EU member states have adhered to various types of carbon tax regimes that have sought to decrease the amount of carbon dioxide that is produced. Additionally, due to the non-binding structure of the Paris Climate Agreement, individual European states have used this agreement as a focusing event, to discuss and implement more green energy and environmental policies and programs. One of the policy options supported by many northern and western European states is the carbon or CO2 tax. These policies have proved to result in different levels of effectiveness, as each of these policy regimes needs to be specifically catered to the social, economic, and political climate and concerns within each of these member states. By taking a closer look at a few of the different types of carbon tax regimes that are used around the European continent, we can gain a better understanding of the actual impact each of these regimes has, as well as the social and political situations in which each of these regimes were formed and implemented.

This paper will seek to understand the role, if any, which carbon tax regimes have on decreasing the overall amount of carbon dioxide that is produced in a state, and whether this difference is significant when compared to the average EU wide carbon dioxide emissions. This is important to understand when thinking about the potential for scaling up any of the currently established carbon tax regimes to a European wide system. The potential for larger scale environmental policies and programs will, in theory, result in a larger positive environmental impact. Additionally, this will assist many European states to meet their agreed upon Paris Climate Agreement goals, as well as establishing better international environmental policies, by the world leaders in ‘green’ policies.

In this paper I will be focusing specifically on carbon dioxide emissions, as carbon dioxide is the most prevalent human polluted greenhouse gas in our atmosphere at the moment, accounting for about 82 percent of all GHG emissions. Lowering greenhouse gas emissions has been and will continue to be an extremely important political, economic, legal, and social debate within the international community as well as within and between states all around the world. Due to the massive scope of this issue, it is important to understand the different types and greenhouse gas emissions, as well as the different sources of these emissions. There are a myriad of different greenhouse gases such as carbon dioxide (CO2), methane (CH4), ozone (O3), and chlorofluorocarbons (CFCs), and it is important to understand that each of these gases varies in the overall amount present in the atmosphere, as well as the overall impact it has to global warming and climate change. Although each individual molecule of carbon dioxide may not be as potent as other greenhouse gases, such as CH4, which is roughly 30 times more effective at trapping heat, CH4 is less prevalent, as it is the second most prevalent GHG, accounting for about 9 percent of total GHG emissions (Nyman, 2015).

The issue of carbon emissions is extremely important and salient in today's societies around the world, due to the massive scale and worldwide implications of climate change and global warming. Although these words are sometimes used as buzz words in order to enact a gut political reaction, they are also serious climate concerns, which try to express how massive and global environmental problems have become. Carbon dioxide as the GHG that is in highest concentration in the atmosphere, is the best-known and studied gas that is contributing to these global climate concerns. Policies such as carbon taxes attempt to address growing public concerns regarding the increase of carbon dioxide polluted into the environment, as 97 percent of climate scientist agree that global warming and climate change is occurring and that humans are directly responsible for this increase in global climate temperatures (Scientific Consensus: Earth's Climate is Warming, 2019). Furthermore, in 2014 the Intergovernmental Panel on Climate Change (IPCC), a United Nations body of climate and political scientists charged with assessing the science of climate change published their 5th assessment report, in which they concluded that "human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems" (AR5 Synthesis Report: Climate Change, 2014).

Due to the overwhelming support from the scientific community, it has become the responsibility for governments and governing bodies around the world to take action to deal with this climate issue. Although 'green' national policies help to decrease the overall amount of carbon dioxide and pollutants that go into the atmosphere, in order to make a larger and more positive impact not only on the regional but also on the global environment, the EU should look to scale up the national policies regarding the creation and implementation of carbon taxes. It is therefore imperative, that the EU analyze the carbon tax regimes that are already established around some of the member states within the union to see if any of these systems could be scaled up to the EU level, or if the EU should look into the establishment of a multinational carbon tax policy. One of the less economically destructive, and more politically expedient ways for governments to deal with the growing scientific and societal concerns regarding climate change is the implementation of national carbon tax regimes. While the EU claims to be a leader in environmental policies (such as carbon taxes), many EU member states are still producing a significant amount of greenhouse gases. It is therefore important to understand if the establishment of a carbon tax within a state is linked to having direct positive feedback on decreasing the amount of carbon dioxide per capita that is produced within a state.

The paper proceeds as follows. I will first define a carbon tax regime, explain the current policies regarding carbon tax regimes as well as other energy taxes systems at the EU level. I will then look at the carbon tax regimes of three European states including, France, Sweden, and Norway, in order to understand the effectiveness of each of these regimes. I chose these European nations as they each have a comparatively long history of carbon tax regimes, and each has very different forms of carbon tax regimes. This will allow for a better understanding of the actual impact which these three forms of carbon tax regimes have on the amount of carbon dioxide that is produced within these states. These finding can then be extrapolated out to grant a better understanding of the viability of a harmonized carbon tax regime at the European or EU level. I will then compare this policy and academic research to a quantitative analysis of the actual amount of carbon dioxide produced among 27 of the EU member states, as well as Norway.

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Methodology of Quantitative Analysis:

The quantitative data and analysis section of this paper was done by using carbon dioxide emissions per capita data from each of the EU member states (excluding Luxembourg) and Norway from the data collected by the World Bank (CO2 Emissions: Metric Tons per Capita, 2019). The carbon dioxide per capita emissions data was separated into five different European regions: Northern Europe, which includes Denmark, Finland, Ireland, Sweden, the United Kingdom, and Norway; Western Europe, which includes France, Belgium, Germany, and the Netherlands; Southern Europe, which includes Spain, Portugal, Malta, Italy, Greece, and Cyprus; Eastern Europe, which includes Austria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, and Slovakia; and the Balkans, which includes Slovenia, Bulgaria, Romania, and Croatia. CO2 emissions data was then also collected for the three case study states of Sweden, Norway, and France. For the purposes of this paper, I will be including Norway into the average EU carbon dioxide emissions, and I will be excluding Luxembourg from these same calculations. This will be done in order to better compare the average carbon dioxide emissions within states that have carbon tax regimes, with all of the other states within the EU, some of which do have some form of the carbon tax regime, and other with none. Luxembourg is specifically excluded from these calculations as it is an outlier in these calculations due to its small population when compared to its carbon dioxide emissions per capita, and would therefore significantly skew the data in a disproportionate manner regarding its actual size and impact. I look at this quantitative analysis in order to understand if the implementation of a carbon tax regime has any significant effect on the actual amount of carbon dioxide that is produced by a country.

I chose Sweden, Norway, and France as my case studies for this paper, due to the differences in each of these states approaches to implementing a carbon tax regime, as well as in order to gain an understanding of how these national approaches have impacted the CO2 per

capita emissions of each of these states. Furthermore, these case studies were chosen, as each of these states implemented their respective carbon tax regimes at an earlier time period when compared to other EU member states, some of which do have carbon tax regimes, others do not.

The collected data was then organized by year starting from 1960 through 2014. The average of this carbon dioxide emission data was then calculated out for each region, and well as the EU (and Norway) as a whole. This however became complicated, as many of the Eastern states, along with Germany, did not have carbon dioxide emissions data before 1992. The analysis for this research has to take into account the lack of information available on the post-Soviet and Communist states, before the fall of the Soviet Bloc, as well as other states, like Croatia, which were historically part of another country. There are therefore two graphs used in this analysis showing the emissions information from 1960-2014, as well as 1992-2014. These time series graphs display the overall EU average compared to the carbon dioxide emissions from the three case study states, in order to compare how and if these carbon tax regimes actually result in a comparable decrease in overall carbon dioxide emissions per capita. Further information regarding the comparison of the regional averages with the three studies can be found in the appendix of this paper. These time series graphs will be useful to understand how the regional carbon dioxide per capita data compares with the case studies discussed in the research, in order to understand if there are regional differences in the effectiveness of national carbon taxes.

Literature Review:

In this section I will discuss they previous research that has been done on carbon tax regimes, as well as other forms of policy tools that have been used by governments in the attempt at lowering CO2 emissions. I will also discuss the different case studies used in this paper in order to understand how each of states have implemented their various carbon tax regimes.

Academic literature on Carbon Taxes:

A carbon tax is a policy tool that can be implemented by a state or governing political body with the authority to tax, that imposes a tax "on the carbon-based energy sources according to their carbon contents," and are used to "reduce CO2 emissions emitted into the atmosphere, through their pricing effects on fuel consumption and energy selection" (Hensher, 2008). This

means that this policy instrument uses economic and fiscal pathways and reasonings to establish an ‘sin tax’ on the use and sale of the combustions of fossil fuels and other carbon dioxide emission sources. This tax shift policy is meant to be somewhat coercive in nature as it seeks to limit the use of the sources of carbon dioxide emissions by including the unfelt negative externality of the burning of carbon sources for energy, into the cost of using the energy created from the combustion of fossil fuels and to creation of carbon dioxide emissions. By placing an increased price tag on the sources of this pollutant governments are both better able to limit the use and dependence of this energy source, while also at the same time incentivizing research and the use of green energy and renewable sources of energy, such as wind, tidal, and solar energy.

Previous research on the effectiveness of carbon taxes on carbon emissions have focused mainly on specific carbon ta regimes, as well as international carbon tax and cap-and-trade systems, such as the EU-ETS. A study done on the effectiveness of carbon taxes regarding a decrease in carbon dioxide emission stemming from transportation found that a “carbon tax, in the presence of improved fuel efficiency, is likely to be linked to reduced CO2 per vehicle Kilometer,” while not having a significant impact on the total number of kilometers traveled (Hensher, 2008). This shows that carbon tax regimes can be successful in their targeting of decreasing the overall carbon dioxide emissions of a state, and that these regimes can be created to work with other policies, programs, and new technology to result in the desired impact, without causing a significant impact on industry and aspects of citizens’ lives, such as transportation. Furthermore, the establishment of domestic level carbon tax systems will have a significant impact on the local and regional emissions. However, due to the massive scale of this issue, national and regional carbon tax schemes have limited large scale impact on the amount of carbon dioxide that is pumped into the atmosphere. A study done at the Center for International Climate and Energy Research in Oslo found that “under quite general conditions, an international CO2 tax can be designed so that it is both efficient and satisfies whatever distributional objectives one might have (Hoel, 1992). Additionally, this study finds that the “harmonization of domestic CO2 taxes will usually not have the same desirable properties as an international tax” (Hoel, 1992). This is important because it explains how in order to really feel the large positive impacts of a carbon tax, it needs to be established at an international level, and that this international level policy is more likely to produce the desired outcome of decreasing carbon

dioxide emissions than the harmonization of various different carbon tax regimes around the EU, Europe, and the world.

European Union Emissions Trading System:

In addition to the CO2 tax regimes this paper looks at, it is also important to discuss other carbon regulation systems, such as the multilateral European Union Emissions Trading System (EU ETS). This is an EU wide emissions trading scheme, which started in 2005. The EU ETS follows the cap and trade principle, which sets a maximum amount of greenhouse gasses that can be emitted within a specific agreed upon area, with all of the participating states. Within this system, the governing body, the EU ETS in this case, establishes 'allowances' for the amount of emissions that is allowed within all participating states. These allowances are then auctioned off to the participating states and industries, which can then later be traded or sold off between the participants. This scheme is the world's largest emissions trading scheme in the world and was established as a way of fighting global warming. (Ellerman & Buchner, 2007). Climate and environmental protection is a major pillar of European values and is therefore an especially important discussion within the European context. The EU ETS, as of 2013, "operates in 31 countries (all 28 EU countries plus Iceland, Liechtenstein and Norway), limits emissions from more than 11,000 heavy energy-using installations, and covers around 45% of the EU's greenhouse gas emissions" (EU Emissions Trading System (EU ETS), 2019).

In the next sections I will discuss the case studies used in this study to explain the carbon tax regimes seen in three different European states, namely Sweden, Norway, and France. This is done to understand some of the different ways in which carbon tax regimes manifest themselves within Europe. They will be used to compare between the EU average CO2 per capita emissions in order to understand how the carbon tax regimes in these settings impact how much CO2 per capita is emitted.

Sweden:

The Swedish government has been and continues to be one of the leaders in environmental policies and programs. The current Swedish Prime Minister Stefan Lofven set a goal for the country to become greenhouse gas neutral, meaning the state will have a zero carbon footprint, by 2045. They are well on their way to making this goal, and public opinion within the

state has greatly pushed the political drive for these types of environmental, or 'green' policies. This drive toward 'greener' public policy can be seen in the Swedish 2020 energy policy, which established a goal of the state achieving 49 percent renewable energy. This goal was reached in 2013, seven years before its deadline. According to forecasts from the Swedish Environmental Protection Agency in 2017, the state will go far beyond the 2020 goals, reaching a 30 percent decline instead of a 17 percent decline, ending in an overall reduction of more than twice the initially projected rate (Ackva & Hoppe, 2018).

Sweden saw a massive shift in its green energy tax system from 2001 through 2006, in which "environmental taxes were substantially raised while cutting incomes taxes in order to relieve the tax burden on low-income households" (Ackva & Hoppe, 2018). This tax shift was planned to reallocate about 3.25 billion euro by 2010, and the Swedish government raised 1.6 billion euro, while at the same time reducing personal income taxes and social contributions, which disproportionally impacted lower-income individuals (Sweden, 2014). The government used this green energy tax shift to specifically raise the carbon tax, although other environmental regulatory shifts were also given priority during this time. The green tax shift ended in 2006, however from 2007 through 2013 the state increased its environmental taxes and maintained cuts in regressive labor and personal taxes (Sweden, 2014).

Sweden introduced its carbon tax system in 1991 to complement the previously existing energy tax systems within the state. This new policy originally established a tax rate of 27 euro per metric ton, however, as of 2014, this rate is now 149.7 euro/tCO2. This carbon tax reform in Sweden was found to be "by far the strongest CO2 price signal in the world" (State and Trends of Carbon Pricing, 2017). The energy reform introduced by Sweden including several various fossil fuel energy sources including, natural gas and coal. This tax has targeted emissions from a different source including heating, industries, agriculture, and emissions from transportation (Ackva & Hoppe, 2018). The tax specifically targets a reduction in carbon dioxide emissions from six main sectors of the Swedish economy including, agriculture and fishing, off-road transportation, electricity, road transportation, industry, and residential and commercial buildings (Ackva & Hoppe, 2018). This tax now includes any energy carbon emissions, that are not already covered under the EU ETS, and more recently in 2018, Sweden introduced an aviation carbon tax. The results of this addition have seen a slight increase in the prices of airfare,

however more than half of the Swedish population supports this new tax (The Local, 2018). Additionally, the costs of implementing this new tax were very low, as it is being collected through the same system as the already implemented energy tax. The revenue that is collected by the carbon tax goes directly into the Swedish general budget, and from 2000 and 2015, made up about 0.5 to 1 percent of Swedish GDP (Ackva & Hoppe, 2018).

A study done for the Ministry for the Environment, Nature Conservation and Nuclear Safet (BMU) in 2018 found that carbon tax does have a strong effect on specific on sectos which consumers and produced are fully exposed to the full tax rate. There is "strong evidence that the Swedish carbon tax has reduced Swedish road transport emissions by about 10%" (Ackva & Hoppe, 2018). Furthermore, the tax was found to have been highly effective in reducing overall carbon dioxide emissions and was found to be politically feasible, notwithstanding the increased carbon prices forced on consumers of carbon and energy. Part of the reasoning behind this was the overall shift this policy made to other energy taxes creating a reduction in other areas, while at the same time increasing the total amount in which carbon emissions would be taxed.

Norway:

The Norwegian carbon tax system is somewhat more complicated and less straight forward than the Swedish system explain above. In Norway, the carbon tax system covers up to 55 percent of all emissions, with the remaining 45 percent of emissions covered by either the EU ETS or other domestic systems within the state (Zimmermannova et al, 2018). The carbon tax in Norway began in 1991, and initially started at around 45 euro per ton of CO2 on the use of gasoline specifically, and averaged among other sectors and types fossil fuels at about 20 euro per ton. The carbon tax rates in Norway, as of 2014, vary a significantly, from 3.57-61.5 euro per ton of CO2, depending on the industry and type of fossil fuel used (Zimmermannova et al, 2018). The Norwegian carbon tax system has one to the highest carbon taxes in the Organization for Economic Co-operation and Development (OECD).

The taxes on energy in Norway are centered around four more specific areas which include a tax on road usage, a carbon tax on oil and natural gas products in all sectors, a mineral oil tax for the fishing and manufacturing industries, and electricity output (Taxing Energy Use 2018: Norway, 2018). To complicate this further the road usage tax only pertains to biofuels, diesel, and gasoline when it is being used for the purposes for transportation on the road, whereas

the carbon tax applies to natural gas and oil usage in all other sectors; coal is not included within this carbon tax regime. Furthermore, each of the different economic sectors that are targeted by these energy and carbon tax policies is taxed at varying rates with the road sector being taxed at the highest rate. Within the road sector however, the different fuels are also taxed at different rates, where gasoline is taxed at the highest rate in this category, while biofuels and natural gas are taxed at a significantly lower rate as they do not make up a significant share of the pollution from the road transportation sector. Other sectors that are subject to the carbon tax in Norway include fuels for off-road transportation (with varying rates), fuel used in industry (tax rates vary between industries and types of fuel used), fuels from agriculture and fishing, residential and commercial buildings (general carbon tax rate). Due to the complicated nature of the Norwegian carbon tax structure the government, on January 1st, 2018, established a full and standard carbon tax regime set at NOK500 per ton of CO2, or about 57 euro per ton of CO2. In this new policy, a majority of the reduced rate and exemptions were abolished, although some still do remain, most notably within the agriculture and fisheries sectors (State and Trends of Carbon Pricing, 2018).

France:

France established a carbon tax regime in December 2013, in which the French Parliament established goals to increase the overall carbon tax rate from the 22 euro/tCo2 of 2016, to 56 euro/tCO2 in 2020, and eventually 100 euro/tCO2 by 2030 (Zimmermannova, 2018). This new carbon tax policy was called the Climate Energy Contribution (CEC). The original implemented rate at the birth of this new French carbon tax would begin at a rate of 7 euro/tCO2 in 2014, increasing to 14.50 euro/tCO2 in 2015, and then establishing the 22 euro/tCO2 in 2016 (Chrisafis, 2009). However recent political protests in France, most notably the Yellow Vests protests against rising gas prices forced current French President Emmanuel Macron, in December 2018, to announce that the 2019 carbon tax increase would not be implemented. The carbon tax that was implemented but the French Parliament in 2014 was not the first attempt by the French government to pass and implement a carbon tax regime in France. In 2009 the French government attempted to pass a new carbon tax that would apply to oil, gas and coal consumption by business and households, however, this bill was blocked by the French Constitutional Council, who argued that the bill allowed for too many exceptions (Kanter, 2009).

Analysis of the Data:

Figure one below shows carbon dioxide emissions per capita for Sweden, France, and Norway from 1960 through 2014. From this graph, we can see that the implementation of the Norwegian carbon tax in 1991 had a significant impact on the amount of carbon dioxide per capita that was emitted. There does not seem to be a significant decrease in Sweden's carbon dioxide emissions per capita, during the implementation of their own carbon tax regimes, which then raises the issue of other potential confounding variables that could be at play regarding the amount of carbon dioxide emissions per capita in this state. However, we can clearly see that within both France and Sweden there has been a steady decline in the overall amount of carbon dioxide per capita that is being produced by these states. Whereas Norwegian emissions follow a more jagged trend, in which emissions rise until and specific focusing event occurs, such as the carbon tax which was instituted in 1991. Further data statistics will be needed to understand the actual role in which the implementation of a carbon tax will have on the production of carbon dioxide per capita be each state. Furthermore, future data will be able to show the impact that the 2018 Norwegian carbon tax reform, as well as the 2013 French carbon tax policy, will have on the overall carbon dioxide per capita emissions for this state. This will also help to explain whether or not the establishment of political focusing events, such as the establishment of the carbon tax in Norway, will consistently impact the sharp downward trend of carbon dioxide per capita emission in the state.

One noticeable date of interest displayed on the graph below occurs in 1980 when the emissions of the three states all meet at the same value of about 9 metric tons of carbon dioxide per capita. This is interesting as both the French and Swedish trend lines are following a negative slope, meaning that carbon dioxide emission values are decreasing, whereas the Norwegian slope is increasing at a rather sharp rate during this same time. Some additional research explains that from the 1970s-1980s Norway was caught in the middle of the Alta controversy or Alta conflict, which was a massive controversy concerning the establishment of a hydroelectric power plant on the Alta river in northern Norway. These protests of a sustainable energy source may have disrupted the rate that the Norwegian government may have been able to limit the amount of the productions of carbon dioxide emissions contributed by Norway during this decade (Andersen & Midttum, 1985). Another potential explanation for the different track Norway follows compared to that of France and Sweden could have to with population statistics within Norway at this time.

By looking at total fertility rates in Norway we can see a significant drop in the overall fertility rates from 1965 through 1981 (Children Born per Women: Norway, 2019).

Figure 1

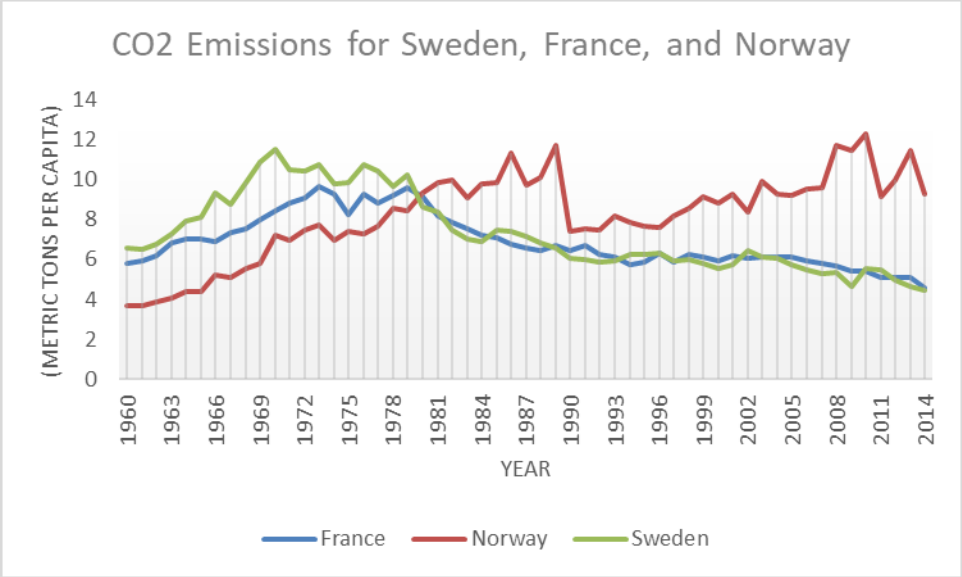


Figure 2 below shows a time series, from 1960-2014, of the average EU carbon dioxide per capita emissions, compared with the carbon dioxide per capita emissions of the three case studies (Sweden, Norway, and France). This comparison was done to see if there was any significant difference in the amount of carbon dioxide per capita that was produced by these three case studies, with a historic and strong carbon tax regime, and the average EU carbon dioxide per capita emissions. By looking at the time series below, we can see that overall the EU average value lies fairly consonant with the case study states. Furthermore, the EU average values are actually consistently lower than the Norwegian values for almost every year after 1980. This may be explained by the reasons listed above, but nonetheless is still important to understand. In this time series, as with Figure 1 above, we can see a massive shift in the amount of carbon dioxide that is produced by France, Sweden, the EU average, and Norway. Following about 1980 there is a long-lasting slow decline in the amount of carbon dioxide per capita that is being produced in both France, Sweden, as well as the EU overall average value. The time series graph does however indicate a decreasing trend found in all of the case studies as well as is the EU average values. This is important as this could be indicating that the establishment of 'greener' policies, such as the carbon tax, are having a positive effect in decreasing the amount

of carbon dioxide per capita that is being emitted into the atmosphere by EU member states, and Norway.

The implementation of other ‘green’ policies, such as the EU ETS, which was implemented in 2005, are also not seen directly in the data. This indicates that there either is no, or at very most a fairly limited link between the establishment of a carbon tax, and a direct decrease in the amount of carbon dioxide per capita emitted by a state. Additionally, this could also be explained by the understanding that carbon dioxide emissions come from a wide variety of sources, and it would therefore require a multivariate approach to see a direct relationship between the establishment of ‘green’ policies, and the amount of carbon dioxide per capita that is produced.

Although Figure 2 is useful in the sense that it grants us a larger historical understanding of carbon dioxide emissions per capita within Europe, it is important to point out the major caveat of using this data blindly, in that many of the EU eastern member states do not have carbon dioxide per capita data information prior to the fall of the Soviet Union. While others were not yet independent states, such as Croatia, which was part of Yugoslavia until the 1990s. The data for these states is available only from 1992 onward. The states that are not included within the EU average of Figure 2 prior to 1992 include, Germany, the Czech Republic, Latvia, Lithuania, Slovakia, Slovenia, and Croatia.

Figure 2

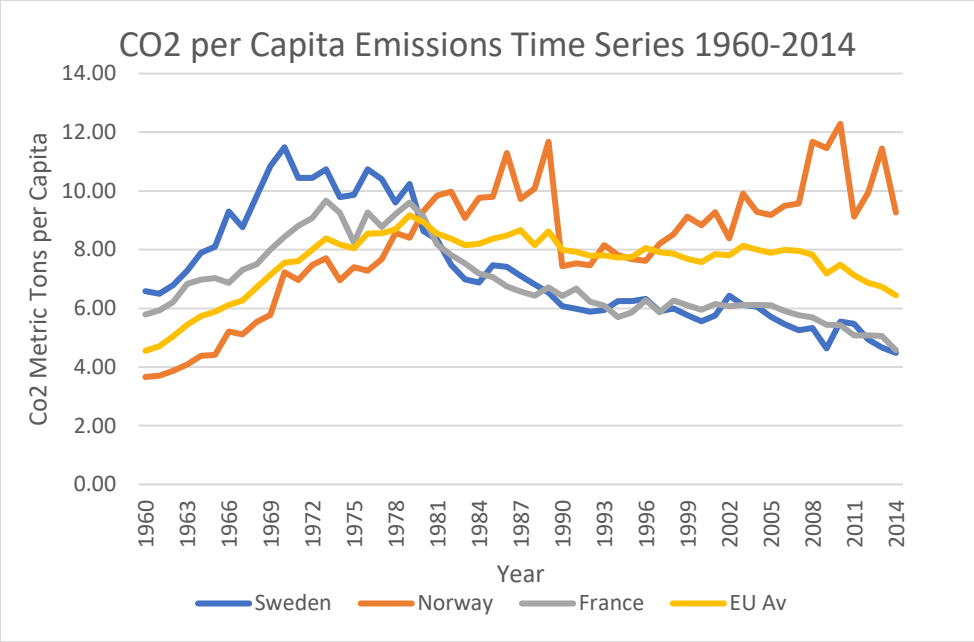
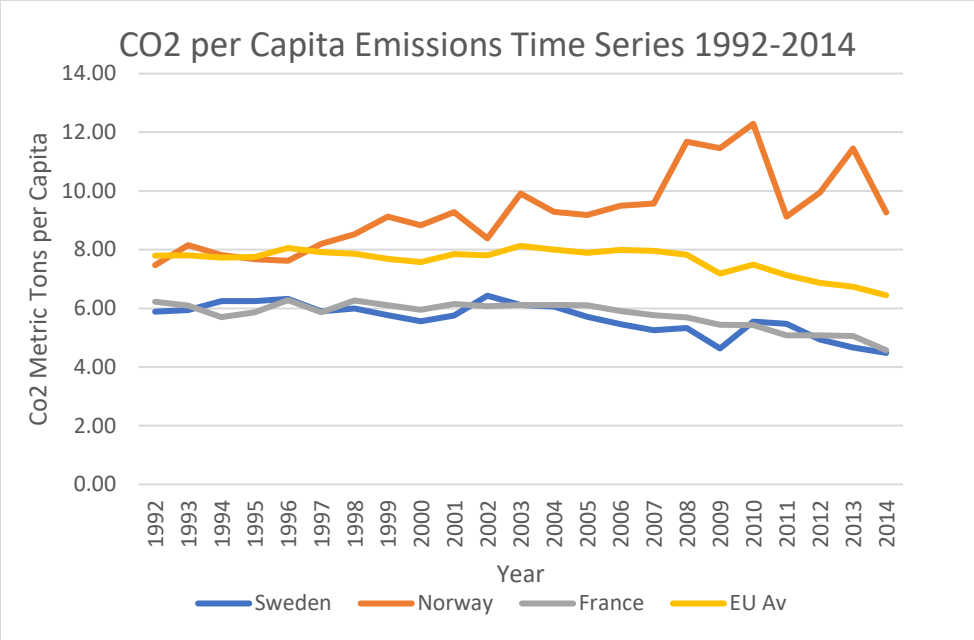


Figure 3 below shows a shorter time series than Figure 2 above, as it begins in 1992 when all of the carbon dioxide emissions per capita are available for all of the countries in question. This time series graph however, tells us an identical story as Figure 2 above and therefore indicates similar analysis and findings as Figure 2. However, figure 3 allows us to better understand what is going on regarding the specific carbon dioxide per capita data for a more thorough, smaller, and more recent period of time. This time series graph indicates that the EU average values trend remain extremely similar, and in fact almost parallel to the Swedish trend. While this may not actually mean anything in real terms, the EU average does follow the Swedish trend, maintaining a value of about 1 carbon dioxide metric ton per capita higher than the Swedish value. Additionally, it is also interesting to see Norway as having the higher carbon dioxide per capita than the average of the EU. This is because they were cited as having some of the most stringent carbon tax policies.

It is important to be able to separate this data out from the previous figure (Figure 2), as Figure 3 allows for better understanding for what was going on in terms of carbon dioxide emissions in the EU and Europe during the decades in which most of the carbon tax regimes were being discussed and implemented, as to have a better understanding of the environmental climate was like at the time in which these discussion and implementation plans were happening.

Figure 3



Conclusion:

This analysis concludes that from the data presented there is no significant indication that the institution of a carbon tax regime will have a direct impact on decreasing the amount of carbon dioxide per capita that is polluted by a state. However, based on the data, I cannot rule out that the institution of a carbon tax regime will have a significant impact on the amount of CO2 emissions per capita that is produced. This is explained in part by the complicated and complex nature of CO2 emissions, as there are many other variables that impact carbon emissions, other than the institution of a carbon tax. Additionally, the time series graphs used in this analysis allowed for a time comparison between the three case studies and the EU average from 1960 through 2014, which enabled the ability to use over 50 years of data on carbon dioxide per capita emissions. This is important because it establishes trends for the records for the EU carbon emissions, which will be essential to for governments, scientists and scholars to understand, in order to figure out ways to successfully decrease the amount of carbon dioxide that is being polluted.

This analysis used a case study approach, by comparing carbon tax regimes in three European states, Sweden, Norway, and France. This was done in order to see how different EU and European nations have implemented a ‘green’ policy such as a carbon tax, within their national systems. This is important for the EU because it sees itself as a leader in environmental

concerns and actions, and as such should be interested in the potential establishment of an EU-wide carbon tax regime, or at least be having more discussions about the steps that can be taken on the EU or intergovernmental levels. These case studies were then compared to the quantitative data of the carbon dioxide emissions per capita for each EU member state, excluding Luxembourg, and including Norway.

The hypothesis for this research, that a state establishing and maintaining a carbon tax would have a direct and significant impact on decreasing the carbon dioxide per capita emissions for that same state, was not supported by the research. This research does conclude that due to the complicated and multivariate and multisource aspects of carbon dioxide emissions, this study can determine that the issue of carbon dioxide emissions is a multifaceted issue that cannot simply be dealt with by the institution of a tax on carbon.

Additionally, there were a number of limitations and caveats about the research, including the fact that there are a myriad of reasons that could explain carbon dioxide emission levels throughout the different states, not just the implantation of carbon tax regimes. Additionally, the carbon dioxide emissions per capita may have skewed the data. This was seen in one of the potential explanations for the increase in the Norwegian carbon dioxide emissions per capita data, in that Norway saw a significant decrease in its overall birthrate, therefore increasing the amount of carbon dioxide per capita, as there were fewer people being born into the country. This same issue could have therefore had a similar impact on other states within the EU average statistic, as well as the regional statistics (for more information about the regional EU statistics look in the appendix). Other caveats about this research include the fact that I could not control for all of the other potential variables that produce CO2 into the atmosphere, the limitation stemming from only having 29 states used in this study, which is slightly below the 30-N required for a large-N study. Therefore, based on this data we simply cannot know, because we do not know how carbon emissions in other countries would have evolved with or without carbon emission tax regimes. Additionally, the research for this study does not include information regarding the existence and stringency of carbon tax regimes in other EU member states and can therefore not discuss the effectiveness of the carbon taxes of the three case studies, as compare to the other states with carbon taxes.

Recommendations:

Further research is needed to answer the question presented by this research, however, this research recommends using the actual carbon dioxide levels that are produced, without considering per capita standardizations, in order to account for a major shift in the demography of a state. Furthermore, this research also stresses that due to the many sources of carbon emissions it is difficult to establish a research design which would hold all other variables constant, save the variable taken into account in the research design. It is therefore imperative that studies relating to such as massively scaled issue such as carbon emissions take this into account when conducting their research, and delivering the results of this research, so that we may gain a better understanding of the different aspects of carbon dioxide and other greenhouse gas emissions.

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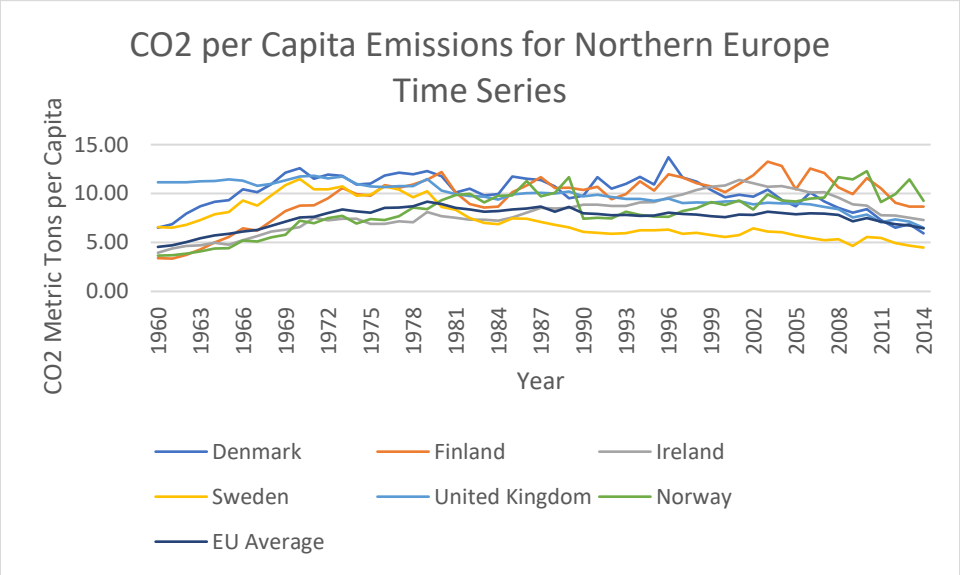
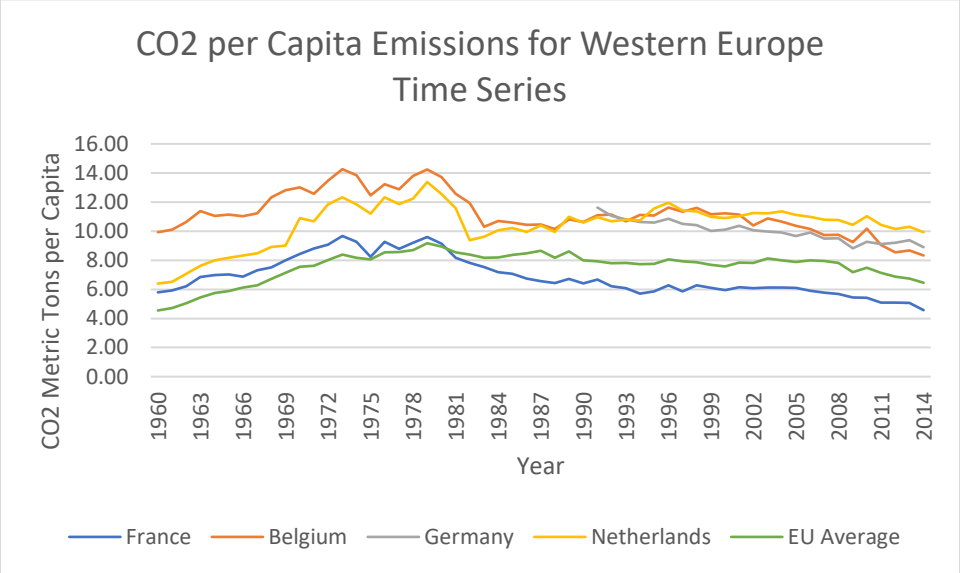
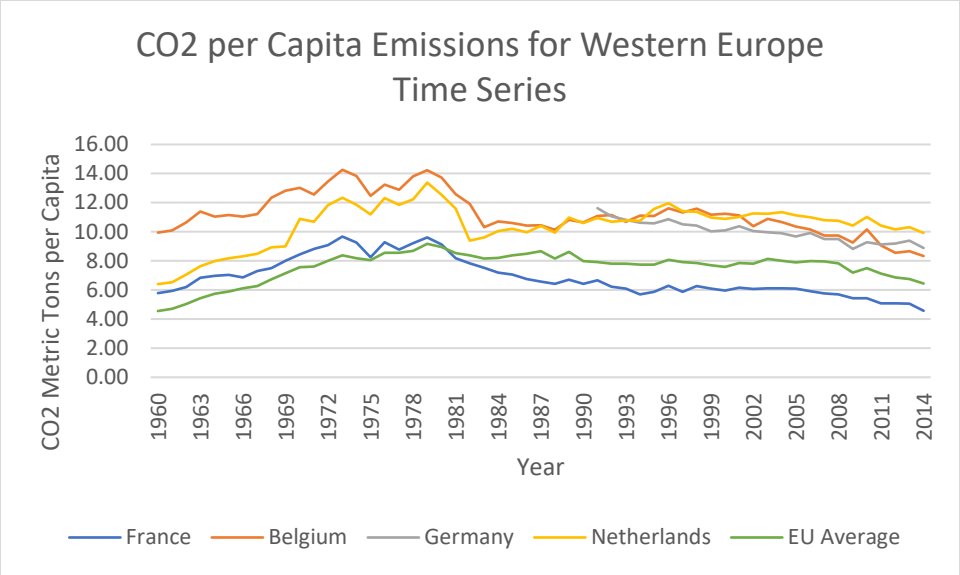
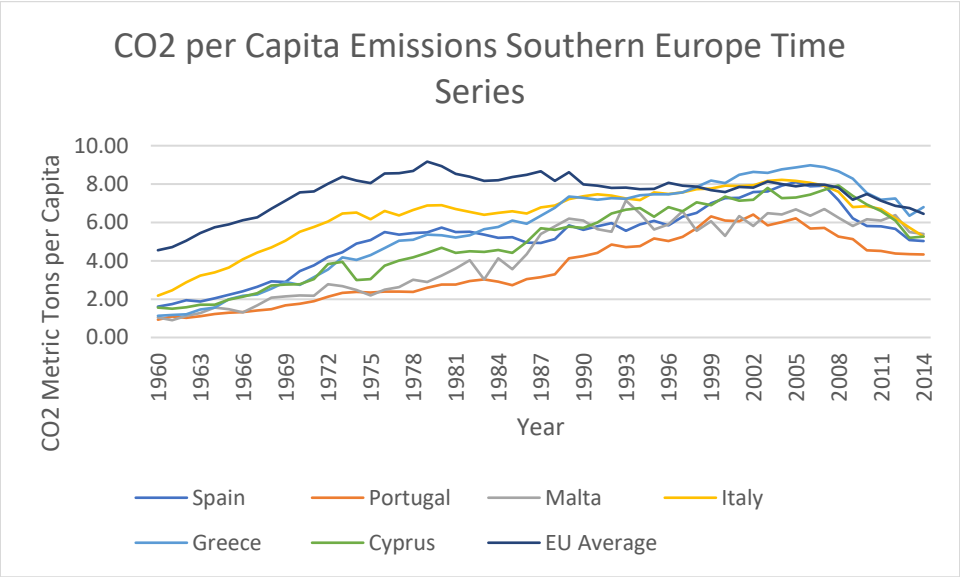
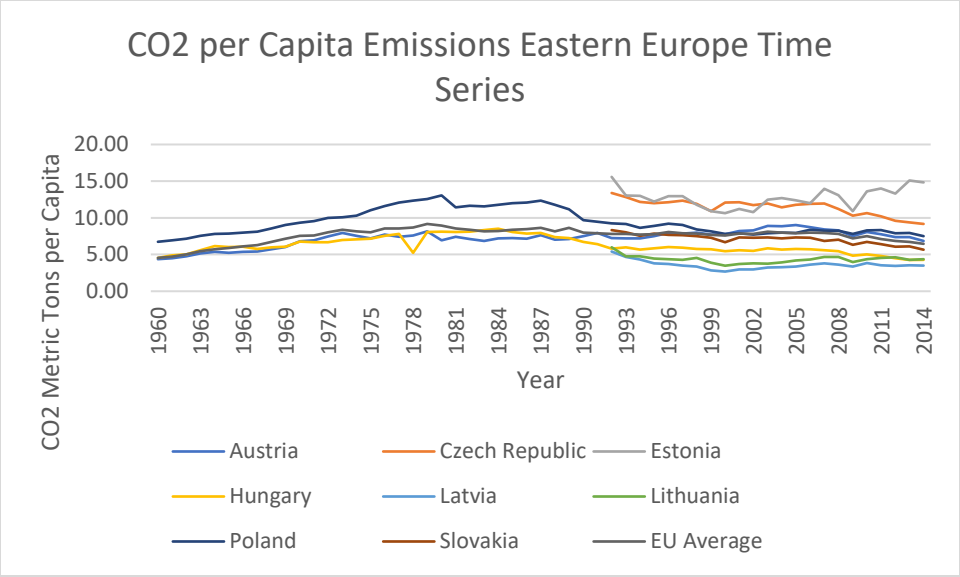
Appendix:

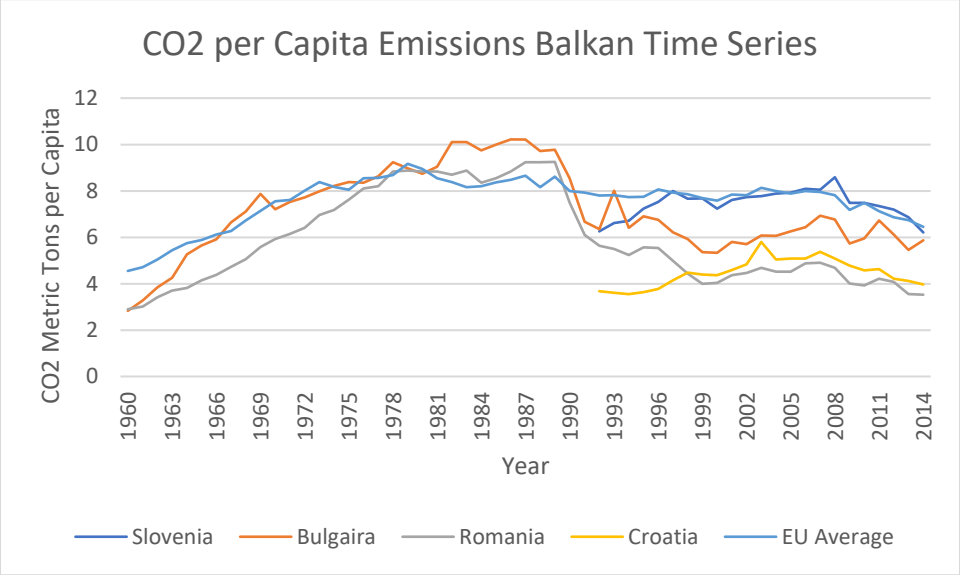





CO2 per Capita Emissions for Western Europe Time Series
CO2 Metric Tons per Capita
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
Year
France
Belgium
Germany
Netherlands
EU Average


CO2 per Capita Emissions Southern Europe Time Series
CO2 Metric Tons per Capita
10.00
8.00
6.00
4.00
2.00
0.00
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
Year
Spain
Portugal
Malta
Italy
Greece
Cyprus
EU Average


CO2 per Capita Emissions Eastern Europe Time Series
CO2 Metric Tons per Capita
20.00
15.00
10.00
5.00
0.00
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
Year
Austria
Czech Republic
Estonia
Hungary
Latvia
Lithuania
Poland
Slovakia
EU Average


CO2 per Capita Emissions Balkan Time Series
CO2 Metric Tons per Capita
12
10
8
6
4
2
0
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
2014
Year
Slovenia
Bulgaira
Romania
Croatia
EU Average