Emissions Trading vs. Carbon Taxes: What Gets Us Closer to a Zero Emissions Future? Lessons from European Implementations

by

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Abstract

In 2017, following the Paris Agreement, the current federal government changed Canada's stance on climate change policy by requiring provinces to implement their own carbon pricing mechanisms by 2018. The provinces are to choose between Carbon Taxes and Emissions Trading Systems. I ask which produces the best results for provinces who have not yet implemented pricing. Using Denmark, Norway, Ireland, and Spain, along with the European Union Emissions Trading System I assess the results these mechanisms have produced over an extended period of time. I find that emission reductions across jurisdictions are inconsistent but provide policy lessons for Canada, both federally and provincially. Federalism in Canada provides its own toughest challenges when it comes to the implementation of consistent policies. As global pressure intensifies on carbon mitigation and emissions reduction, I find three types of costs for the federal government's consideration to reduce its carbon footprint.

Keywords: Climate Change; Environmental Policy; Comparative Politics; Carbon Pricing, Federalism; Canadian Politics

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List of Acronyms

CCME	Canadian Council of Ministers of the Environment
CO^2	Carbon Dioxide
CT	Carbon Tax
ETS	Emissions Trading System
EU	European Union
GDP	Gross Domestic Product
GHG	Green House Gas
IPAT	Environmental Impact as a factor of Population, Affinity, and Technology
PNP	Provincial Nominee Program
POGG	Peace, Orders, and Good Government
STIRPAT	Stochastic Impacts by Regression on Population, Affluence, and Technology
UN	The United Nations
USD	United States Dollar

Chapter 1.

Introduction

In 2016, Canada signed onto the Paris Agreement marking the official start of initiatives to be taken by the federal government in order to tackle the issue of climate change. An election issue which the current government further stressed and displayed a willingness to cooperate on all levels by bringing a large delegation to the Paris conference. The delegation consisted of representatives from federal and provincial governments, and other representatives whose roles vary from public servants to provincial party leaders who did not form government (Smyth, 2015; The United Nations Framework Convention On Climate Change, 2015). This signal that Canada is committed to climate change at an international level has however not been consistent nor fully realized domestically.

Canada has committed to a reduction of 30% in emissions in comparison to 2005 levels by 2030 in accordance to the Paris Agreement (The United Nations Framework Convention of Climate Change, 2017). The first prominent domestic announcement regarding the fight against climate change came in October 2016, when Prime Minister Justin Trudeau gave the provinces a “hard” deadline of January 2018 to implement carbon pricing schemes, going as far as proposing prices per tonne to be considered (Harris, 2016). A second step was taken later in the same year by the federal government further solidifying commitments from provinces in order to meet the 2030 emissions reduction goal that was agreed upon in Paris. This second step was “The Pan-Canadian Framework on Clean Growth and Climate Change” (henceforth referred to as the Framework) and has been signed by all provinces but Saskatchewan and Manitoba (Tasker, 2016). The focus here again has been on carbon pricing and complimentary strategies that would help reduce the country’s emissions while growing the economy and resilience to climate change (Government of Canada, 2017a). The type of carbon pricing mechanisms the government suggested to the provinces through the Framework have been: a direct pricing system (such as Alberta’s Carbon levy or British Columbia’s Carbon Tax), or a cap-and-trade system (such as the ones implemented in Ontario and Quebec) with suggested prices that start at a minimum of

$10 per tonne in 2018, and rise by $10 per year to $50 per tonne in 2022 (Government of Canada, 2017b).

In order to test the potential of these carbon pricing mechanisms suggested by the federal government through the Framework, this study focuses on previously implemented cases that have been used to reduce emissions. It will look to assess these mechanisms in order to determine the optimality of either one for Canadian provinces who do not currently have a carbon pricing scheme in place. It will also look at cases where both of the mechanisms have existed at the same time and assess the results. Thus the questions that this study asks are two-fold: i) Is there a difference in the effectiveness of cap-and-trade systems (henceforth referred to as Emissions Trading Systems or ETS) and State level direct pricing or carbon taxes (CT)? and ii) What are the institutional and jurisdictional challenges that exist for Canada in implementing these mechanisms?

To answer these questions, this study will proceed in six phases. First it will provide a definition of Carbon Taxes and Emissions Trading Systems along with their advantages and disadvantages. This section will also include an overview of the European Union Emissions Trading System, the largest and most criticized system in the world, as all cases in this study are affected by this scheme, it requires an understanding. Second, it will identify the problem from an environmental, political, and jurisdictional perspective for Canada. Third, it will outline the methodology and identify cases that provide long term data regarding the implementation of each of the mechanisms separately as well as concurrently. Fourth, it will utilize multiple regression models assessing the relationships and changes in emissions that have resulted from their application as guided by the IPAT formula. Following this, it will identify the sectors targeted by the pricing and use of the revenues generated in order to explore the changes in emissions in each jurisdiction. Fifth, it will provide a review of the current situation and the challenges Canada may face provided its jurisdictional separation, and history with environmental policy. It will conclude by identifying lessons that Canada can learn from earlier implementations in other jurisdictions and provide considerations for the federal government in order to ensure that the goals set aside for the country in 2030 are met.

Overall, this study finds that both of the pricing mechanisms have generally yielded reduction of emissions in the jurisdictions tested. However, the results from each mechanism have been inconsistent and come short of meeting the emissions targets that have been set forth within these jurisdictions. Canada needs to be attentive of the targeted sectors for its pricing strategies and ensure coordination across jurisdictions in order to strive towards the targets it has set for itself. The study finds that the federal government could be justified in implementing a Canada-wide carbon pricing mechanism in order to directly influence emissions reductions, but it may not be in its best interest to do so as this could be met with political backlash from a provincial level and private institutions.

1.1. Definitions

1.1.1. Carbon Taxes

As suggested above, a Carbon Tax or direct pricing is a fixed price on carbon or emissions (Freebairn, 2014). In most cases, this acts as a tax on consumption of fossil fuels that lead to the emissions of carbon dioxide (CO^2) or its equivalents (Hsu, 2012). There are four distinct advantages in applying a carbon tax (CT), 1) it is relatively **simple** in its implementation, 2) a tax by definition - **generates revenue**, 3) a tax offers **cost certainty**, allowing for long term planning, and 4) it sends a **clear signal** to polluters that they will be paying the cost of their pollution (Avi-Yonah & Uhlmann, 2009, pp. 37-44). This signal sent by governments is represented in the market as an incentive for companies to innovate and develop new green technologies that reduce their emissions and their costs of complying with the tax (Meltzer, 2014). These concepts do an excellent job in outlining the factors that likely played a hand in the early adoption of this mechanism. As the cases used in this study will show, taxation has been the oldest method used to promote environmental considerations. The use of revenues and the sectors from which they are derived have differed in some cases and these will be discovered in the comparative case study section.

There are also disadvantages that have been outlined by researchers regarding the application of CTs regardless of the jurisdiction involved. The most prominent of the disadvantages faced by a tax is the concept of benefit uncertainty. This uncertainty states that a CT does not directly control greenhouse (GHG) emissions to a specified

level (Burney, 2010) with no guarantees that any given tax will result in the desired reduction in emissions (Avi-Yonah & Uhlmann, 2009). A second disadvantage that is important to highlight is the concept of coordination in the long term. When comparing a Carbon Tax to an Emissions Trading System it is hard to ignore the inability of a tax to coordinate with other systems. This is directly related to a benefit of Emissions Trading, where polluting permits, if allowed, could be sold across different systems with more ease than reductions from CTs. Avi-Yonah & Uhlmann mention this in their work as they highlight the issue for the US, the case in their study, and the feasibility of a long term vision that may include directly transferring allowances to the likes of the EU ETS (2009). Political feasibility rounds out the top level issues that are faced by CTs. As Burney outlines, the control of GHG emissions through a "tax" tends to pose political challenges for policymakers, simply due to the stigma that is placed on the word (2010). This sentiment of resistance is also reflected by David Pearce (1991) who states that political resistance is due more or less to the introduction of a "new tax" and the sensitivity that comes with it. This is seen in Canada with the hesitation of Saskatchewan and Manitoba in signing onto the Framework due to concerns surrounding its effects.

For the rest of Canada, however, it can be argued that there has been a shift in attitudes. 76% of citizens support a move towards a more aggressive stance on supporting development of clean energy and clean technology industries (Ekos Reasearch Associates INC., 2016) but support for the idea of a tax is questionable. For example, a regional sales tax to help fund the transit system in the Greater Vancouver Area was defeated (Bula, 2015) and the aforementioned provinces of Saskatchewan and Manitoba refusing to sign The Pan-Canadian Framework on Clean Growth and Climate Change and implement a carbon pricing scheme (Lambert, 2017). Another argument that is presented by critics of CT is that there are those who believe that it may not work quickly or strongly enough in order to bring about changes in behaviour, despite price (Hsu, 2012). However, Hsu also counters this with the standard economic answer which states that "price increase will lead to a decline in consumption" (p. 140). Some of these disadvantages can be countered through the implementation of an ETS.

1.1.2. Emissions Trading Systems

Under an emissions trading system (ETS), an overall emissions limit is set, called the cap, and institutions who emit less than the cap can sell or trade their pollution rights

(Cohen, Wannemacher, & Weisbecker, 2014). The cap that is set would decrease over time until the desired levels of emissions are reached by the jurisdiction that is implementing the system (Avi-Yonah & Uhlmann, 2009). In order to ensure these desired levels, only limited credits are allocated, with installations and penalties applied per unit of pollutant outside of this allowance (Carmona, Fehr, Hinz, & Porchet, 2010). Although slightly more complicated than the descriptions above, this embodies the basic concept of an emissions trading system (also referred to as a cap and trade system). It tackles benefit uncertainty by setting the cap that directly contributes to the emissions reduction goal, it encourages coordination with other jurisdictions that have a similar system in place, and it avoids the stigma of a tax thus becoming more politically feasible in theory.

The largest challenge regarding the implementation of an ETS is the amount of time required to set it up, as this would likely need a new piece of legislation that requires its own considerations (Avi-Yonah & Uhlmann, 2009). The authors also state that "an elaborate mechanism would need to be set up to distribute and collect allowances and to ensure that allowances are real… and that polluters are penalized if they emit greenhouses gases without an allowance (pp. 39-40). New taxes are generally simple to introduce as they can be implemented via a single piece of legislation and are often implemented in this manner. Setting up a new cap and trade system adds another level of challenges and processes that must be considered. A second disadvantage is that of durability. Rabe (2015) states in his work that many cap and trade systems are dependent on entrepreneurial support as well as ideational support and the survivability of such system is unclear with inevitable election cycles. Furthermore, markets likely develop slowly and involve high initial costs before the trading is accepted and transaction costs diminish (Golby, 2000). Although an emissions trading system is a tool that can encourage greater adoption of innovations around deterrence compared to a carbon tax, the tax holds superiority in ease of adoption and implementation.

1.1.3. European Union Emissions Trading System (EU ETS)

As all cases that are being discussed in this study are on some level related to the EU ETS, details on the operations and background of the system are required.[1] The early concepts of this program came after the negotiation of the Kyoto Protocol in 1998 where the idea of a cap and trade system was first mentioned (Convery & Redmond, Market and Price Developments in the European Union Emissions Trading Scheme, 2007). Convery (2009) states that this program came into being after two failed attempts made by the EU in order to address climate change. The first failure outlined by Convery is the proposed EU-wide carbon energy tax proposed in 1992. Which after years of lobbying was formally withdrawn in 1997 due to the opposition it faced as an extra tax on top of what was already present at a Member State level (2009, pp. 392-3). The second failure that spawned the EU ETS was the unsuccessful fight the European Commission engaged in with the Kyoto Protocol in 1997. Despite the Commission's lack of appetite, the Protocol went forward with the inclusion of trading as a flexible instrument that can be used to fight emissions in jurisdictions (Convery, 2009). However, this attitude changed within six months of signing as the Commission soon embraced it as a cornerstone of their climate change policy and thus laid the foundation for the EU ETS.

The European cap and trade program was initially enacted in 2001 but was not introduced fully until 2005 (European Commission, 2016a). This began the journey of the world's largest cap and trade program that would become (arguably) the most important market based application of economic principles on the issue of climate change (Ellerman, Marcantonny, & Zaklan, 2016). When initially implemented, the member states within EU ETS would face two "caps". One was implemented in each country as outlined in the Kyoto Protocol, and the second is a cap for the EU ETS as a whole which represented the allowances that were allocated to the trading sectors in each country (Convery & Redmond, Market and Price Developments in the European Union Emissions Trading Scheme, 2007). In 2013 there were some major changes made to the EU ETS. Although it would continue with free allocation for industries deemed crucial for economic development, it would adopt three changes: i) adoption of an EU wide cap that would decline 1.74% each year, ii) adoption of auctioning as the basic allocation

[1] The EU has committed to reduce at least 40% of emissions by 2030 compared to 1990 levels (The United Nations Framework Convention on Climate Change, 2016).

principle for the electric utility sector, with industrial sectors to be phased in by 2027, and iii) a change in offset provision that allowed for the ETS to expand with other cap and trade systems (Ellerman, Marcantonny, & Zaklan, 2016). Compliance penalties are set for those who fail to comply with the system, set at €100/tCO^2 emitted and rising with inflation (European Commission, 2016a). As it stands today, the EU ETS includes the 27 member states as well as Norway, Iceland, Liechtenstein, and Croatia (European Commission, 2016a) with the cap amount set to 1,927 million tCO^2 equivalent for 2016 (IETA, 2015), with the aforementioned decreases.

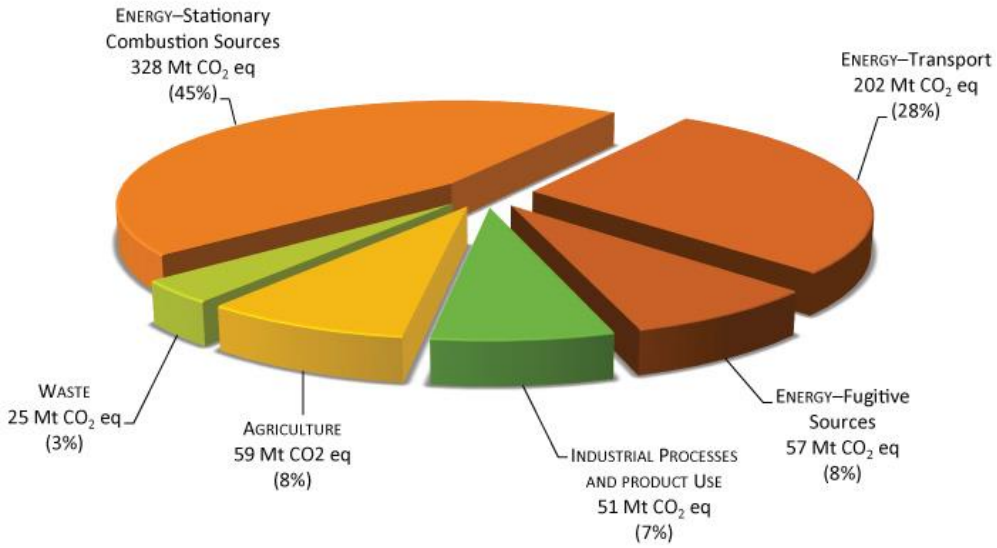
The EU ETS is not without with its critics, the most prominent argument that is made regarding the system involves the market weaknesses that are faced by the system. Observers of the system indicate, the economic crisis between 2008 and 2009 created an environment where industrial output decreased and induced a "surplus" of allowances on the market (de Perthuis & Trotignon, 2014). de Perthuis and Trotignon state that there are three causes that have create the malfunction in the European market. First is the unpredictable decline in activity since the 2008 economic crisis. Second, is the high use of carbon offsets over a short period of time and finally, the interactions between the allowance system and other energy as well as climate policies, mainly renewable energy and energy efficiency policies that hold to potential to drive emissions within the EU ETS down regardless of the price the system places on carbon (de Perthuis & Trotignon, 2014, p. 102). These causes and issues have not been fully addressed by the system, as it still suffers from these ailments. Although no all-encompassing remedy has not been prescribed, these issues serve to provide us with warnings that Canada must heed when designing policies within its borders.

Having defined the mechanisms that will be the subject of this study, and some challenges they have faced, we can now turn our attention to Canada and where it stands on its environmental, political, and jurisdictional challenges in implementing these. As a relatively new jurisdiction looking to implement either a CT or ETS within its borders, the EU ETS offers insights into the challenges and benefits in implementation of both mechanisms separately and in conjunction. Canada, however, is shaped by its own history in a different manner than the EU ETS. Prior to proceeding with analysis of the mechanisms, highlighting Canada's inheritance in this realm will allow us to draw more topical inferences from the results.

1.2. Canada's Inheritance

Canada has faced a unique combination of challenges from environmental, political, and jurisdictional perspectives that have led to an inconsistent track record in the realm of environmental policy. From an emissions standpoint, Canada has seen a 68.7% increase in its GHG emissions between 1990 and 2012 (World Bank, 2017a). At the time of the abandonment of the Kyoto protocol (2006), to be discussed further below, Canada would have had to see a decrease of over 25% in its emissions to meet the goals set forth in the agreement (Winfield & Macdonald, 2012). As of 2015, the energy sector consisting of Stationary Combustion Sources, Transport, and Fugitive[2] Sources was responsible for 81% of all emissions that were generated (Environment Canada, 2017). According to the Framework, pricing as well as complementary initiatives would revolve around these areas. This shows that the federal government has targeted the right sectors in order tackle the issue of emissions being produced within the country. Implementation of these policies however adds a layer of complication from a leadership as well as jurisdictional perspective.

Figure 1 – Sources of Emissions in Canada (Environment Canada, 2017)



Before the current Liberal government took power, the previous government of Canada led by Stephen Harper's Conservatives took a direction that worked to weaken policies in the climate change realm. Driven by ideology, this government adopted a

[2] Fugitive emissions refers to emissions that are produced by: Petroleum Refining Industries, Mining and Upstream Oil and Gas Production, Pipeline Transport (Environment Canada, 2017).

direction that worked to disassemble climate policies that were put in place by the Liberal government they replaced (Winfield & Macdonald, 2012). This came to a punctuation in the international stage on December 2012, when the secretary-general of the United Nations (UN) put into effect Canada's official withdrawal from the Kyoto Protocol which had been submitted a year earlier (Kneteman, 2013). The preamble to this development complimented that government's ideology through a stance of non-compliance to the Protocol that had been publicly stated for the years leading up to the withdrawal (Metz, 2013). The change of direction from the federal government opened the door for Quebec, Ontario, British Columbia, and to an extent Alberta to implement their own policies regarding climate change (Winfield & Macdonald, 2012). These are the same provinces that have a carbon pricing scheme in place during the completion of this study. Beyond the initiatives taken by these provinces there is a lack of other concrete initiatives across Canada that contribute directly to the reduction of Greenhouse Gas (GHG) emissions to meet the standards agreed to at the Protocol and beyond. The provincial level initiatives and an adoption of a limited role by the federal government in environmental regulations (Weibust, 2010) have worked to create and possibly reinforce confusion as to which level of government holds jurisdiction over which aspects of climate change policy.

The federal government's choice to not exercise the powers the Supreme Court says it holds (Weibust, 2010) leaves the fate of international agreements in the hands of the provinces who choose to directly act upon it. This will be further explored in the Canadian Context chapter of this study. Fast forwarding to the Paris Agreement, the most recent multi-national tool being used to replace the Kyoto Protocol, there seems to be a shift back towards a greater importance placed on climate change. The current Liberal government led by Justin Trudeau has taken actions to place more emphasis on the climate change front. The framework itself embodies a vision of "collaborative federalism" described as the process by which national goals are achieved not by the actions of the federal government or use of federal spending power, but by some or all of the 11 governments working together (Cameron & Simeon, 2002, p. 54). However, due to the large variance in resources available and salience of the issue of climate change in Canada, strong federal leadership will likely be needed in order to achieve the goals set forth for Canada in this agreement replacing the Kyoto Protocol.

Provincial variations go beyond that of resources and are also reflected in regional economies and energy mixes within the country's borders. The Alberta and Saskatchewan economies are based in the extraction and export of fossil fuels; Quebec, British Columbia and Manitoba are abundant in hydroelectric resources allowing them to enjoy a "low carbon" market while Ontario, a high consumption province, concerns itself with implications of climate change policies on the energy-intensive manufacturing sector (Winfield & Macdonald, 2012). This dictates that a one-size pan-Canadian solution will not resonate well in all provinces and furthermore is simply not feasible, leading us back to the idea of collaborative federalism. In order to understand the parameters of collaboration, the jurisdictional separation of powers and the level to which authority is granted should be outlined.

The environment is not a specific area of jurisdiction that is assigned to an order of government in the Constitution Act, 1867 (Government of Canada, 2010a). As such, the scope of issues determines the level which holds legislative power. As pollution can occur within a province and also crosses borders, Canadian courts have also decided that the regulation of harmful emissions falls within the competencies of both orders of government (Winfield & Macdonald, 2012). There are, however, specific instances in which the federal government holds exclusive power. The federal government holds jurisdiction over the regulation of emissions of GHG based on the power it holds to regulate toxic substances as an aspect of criminal law (Backlumb, 2013). It is also within the powers of the federal government to negotiate international treaties on behalf of the federation, although this authority is not specifically stated in the Constitution Act, 1867. Initially, under section 132 of the Act, the Canadian parliament was granted the responsibility to implement treaties agreed upon by the British Crown. However, as the government of Canada gained full powers over its affairs this power to negotiate, sign, and ratify international treaties devolved onto the executive branch (Barnett, 2012). The exercise of this power has been evident especially in regards to climate change and trade among others. As mentioned above, the exchanges that were made with the UN and other parties involved in the Kyoto Protocol and the Paris Agreement were done predominantly by the federal government. The presence of provincial representatives added a further dimension to the negotiations, allowing those with direct involvement with climate change initiatives within their respective borders in the past a seat at the table. The presence of representatives from the second level of Canada's government

were not required to ensure Canada's entrance into agreements; as discussed in a later chapter, the federal government could have acted on behalf of the provinces if they saw fit.

The provinces, on the other hand, hold jurisdiction over the control of GHG emissions as they pertain to most types of buildings, businesses, industries and intra-provincial transportation (Backlumb, 2013). The sheer number of responsibilities that fall under the jurisdiction of provincial governments is enough to outline the decentralized nature of this policy realm in Canada. This is also compounded by the lack of provisions that would allow the federal government to act in place of a province if that province is failing to protect the environment (Weibust, 2010). To further add to this issue, the few federal laws that do exist have been delegated to the provinces (p. 217). This exemplifies the nature of the jurisdictional and institutional overlap problem when it comes to environmental policy in Canada. Initiatives and jurisdictions that are federal in nature have been delegated to the provinces and have blurred the lines of responsibility. It is only natural to presume that, although these powers "granted" to the provinces are not permanent, re-centralizing these authorities would likely create backlash for the federal government.

This practice resembles Thelen's (1999) description of Institutional Sociology's path dependence that states collective outcomes, namely institutions, are constructed as an embodiment of shared cultural understandings. According to Pierson (2000), through "self-reinforcing or positive feedback processes" (p. 251) a single equilibrium is reached. With this established policy direction for institutions, the cost of switching from one alternative to another increases and distinguishes formative moments from phases reinforcing divergent paths. These environmental, political, and jurisdictional issues are just the tip of the iceberg when it comes to carbon pricing for the federation and will be discussed in more detail within this context in a later chapter of this study. The challenges that come with these issues need to be understood at a basic level if we are to extrapolate their implications on any lessons that we learn from outside jurisdictions to Canada. These nuances make Canada unique but also provide ample opportunities through which successful aspects of previous carbon pricing initiatives can be applied to Canada. In the following chapter the theoretical frameworks, methodology, and limitation of this study will be outlined in order to infer possible results for Canada from jurisdictions outside of it.

Chapter 2.

Methodology

The analysis will be done through a mixed methods comparative study of the implementation of each approach in different jurisdictions. The cases for Carbon Taxes are: Denmark and Norway. The cases representing ETS will be Ireland and Spain with the EU ETS providing quantitative analysis of the effects of a large scale in the intermediate term. The EU ETS will assist in providing analysis of the effects of both cases existing at the same time within the same jurisdiction from a quantitative perspective with Denmark and Norway furthering analysis from a qualitative perspective. The cases selected for this study were done through the Diverse Case selection method defined by John Gerring. The objective of this method of case selection is to achieve maximum variance along relevant dimensions (Gerring, 2012, p. 97). Due to the small-N nature of the samples used for each mechanism being studied, this method would offer the most strength in terms of representativeness (Gerring, 2012, p. 100). As the end goal of Gerring's method is to achieve proper representativeness, this study will focus on utilizing these cases where there is a variance on the CT amount and the use of their revenues, the ETS cases have been chosen due to their capacity to represent changes as a result of variances in the cap and the differences in reinvestment. The cases have been selected based on these variances in order to analyze the causal effect this has on the factors of direct analysis between the two mechanisms. Norway and Denmark have been chosen due to their longevity in the application of CTs, implemented in 1991 and 1992 respectively (Sumner, Bird, & Dobos, 2011, p. 929). These cases will offer an advanced record of the effects that the application of a CT has over a long period of time. As the world's largest ETS program and centrepiece of Europe's climate policy (de Perthuis & Trotignon, 2014, p. 100) the EU ETS provides ample insight into large scale effects of a carbon pricing strategy while offering quite a few cases that qualify for this study. Ireland and Spain were chosen to represent a variation in the caps that were present along with the reported use of the revenues (Carl & Fedor, 2016). The summary of these cases are represented in Table 1.

It is also imperative to note that there will be restrictions placed on time in order to reflect the purity of the mechanisms and to limit the interactions they have with each

other. Thus this study will focus on defining the relative progress these jurisdictions have made in the realm of GHG emissions reduction. Furthermore, the factors that will be used to directly compare the two mechanisms and jurisdictions will be: (i) trends in and levels of GHG emission reduction; and (ii) exclusions or modifications made within each mechanism, i.e. excluded sectors, varying Carbon Tax amount between sectors, the cap level etc.

The analysis of the cases and their implications will be done in two stages. First, we will provide quantitative analysis of the results from the selected cases within the time frame where they have applied the policy mechanisms being tested, see Table 1 for details. This will provide us with results that can offer a comparative medium for two otherwise different mechanisms. The mechanisms vary in terms of implementation methods, processes, and how they encourage changes in behaviour. These results, while controlling for external factors with a direct influence on emissions, will allow insight into how the latter three have changed under and influenced the results. The second stage will consist of the adoption of one or both of the mechanisms across Canada at a national level. The focus here will be placed strictly on the institutional and jurisdictional challenges that must be addressed in order to achieve positive results. The comparative cases should offer insight into possible target sectors for emissions reductions as well as use of revenue options, both of which are subject to institutional and jurisdictional challenges. This will be done through the lens of historical institutionalism and more specifically, path dependency and carbon lock-in literature. These have shaped Canada today and as such can offer insights into the costs of moving to more carbon mitigation based policies.

Table 1 – Summary Table of Cases

Jurisdiction	Mechanisms	Time Frame	Tax Amount per metric tonne of CO^2 and cap amount	Sectors Affected	Use of Revenue
Norway	Carbon Tax and Both Mechanisms (CT and ETS)	1991-2007 (conception of CT to entry into EU ETS) 2008-2014 (coexisting with EU ETs)	$15.93-$61.76 USD	Gasoline, light and heavy fuel oil; oil and gas in the North Sea; Sectors with reduced tax: the pulp and paper industry, fishmeal industry, domestic aviation, domestic shipping of goods, and the continental shelf	Initially: Government's budget and into a special pension fund for Norwegian citizens Post 2013 raise in CT: 30% Green Spending, 40% General Funds and 30% Revenue Recycling
Denmark	Carbon Tax and Both Mechanisms (CT and ETS)	1992-2005 (conception of CT to entry into EU ETS) 2006-2014 (coexisting with EU ETs)	$16.41 - $31 USD	All consumption of fossil fuels including natural gas, oil and coal	Initially: 60% returned in the form of tax breaks; 40% towards environmental goals As of 2016: 5-10% Green Subsidies, 45-50% General Funds, and 45% Revenue Recycling
EU ETS	Emissions Trading	2005-2014 (data availability)	2,084 million tCO^2 in 2013, decreasing in a linear way by 38 million tCO^2 per year	Power stations and other combustion, refining of mineral oil, coke, cement clinker, ceramic products by firing, glass, iron or steel, lime or calcination of dolomite or magnesite, metal ore roasting, pulp, paper or cardboard, black carbon, bulk organic chemicals by cracking, reforming, partial or full oxidation, drying or calcination and geological storage, hydrogen, synthesis gas by reforming or partial oxidation, mineral wool insulation material, nitric acid, production of adipic & glyoxal acid, production or processing of: ferrous & non-ferrous metals, primary/secondary aluminium, soda ash and sodium bicarbonate	Country dependent

Jurisdiction	Mechanisms	Time Frame	Tax Amount per metric tonne of CO^2 and cap amount	Sectors Affected	Use of Revenue
Ireland	Emissions Trading	2005 – 2009 (ETS Only) 2010- 2014 (Carbon Tax Introduced)	2,058 million tCO2 (under EU ETS cap)	Power stations and other combustion, refining of mineral oil, coke, cement clinker, ceramic products by firing, glass, iron or steel, lime or calcination of dolomite or magnesite, metal ore roasting, pulp, paper or cardboard	Predominantly General Funds with roughly 12.5% of CT revenues earmarked for Green Subsidies
Spain	Emissions Trading	2005 – 2014 (latest emissions data available)	1,92 million tCO^2 (under EU ETS cap)	Includes sectors mentioned above and: black carbon, bulk organic chemicals by cracking, reforming, partial or full oxidation, drying or calcination and geological storage, hydrogen, synthesis gas by reforming or partial oxidation, mineral wool insulation material, nitric acid, production of adipic & glyoxal acid, production or processing of: ferrous & non-ferrous metals, primary/secondary aluminium, soda ash and sodium bicarbonate	Climate and energy related measures

Sources: Norway (Sumner, Bird, & Dobos, 2011; Lin & Li, 2011; Environmental Defense Fund, 2013; Carl & Fedor, 2016); **Denmark** (Balleisen & Moss, 2010; Sumner, Bird, & Dobos, 2011; Gale & Barg, 2014; European Commission, 2016b; Carl & Fedor, 2016); **EU ETS** (European Environment Agency, 2016a; European Environment Agency, 2016b); **Ireland** (Anderson, Convery, & Di Maria, 2011; Conefrey, Fitz Gerald, Valerie, & Tol, 2012; Czyrnek-Delêtre, Chiodi, Murphy, & Ó Gallachóir, 2016; European Commission, 2016a; European Commission, 2016b; Carl & Fedor, 2016) **& Spain** (IETA, 2015; Carl & Fedor, 2016; European Environment Agency, 2016a).

2.1. Aim of Study

As a resource-based and diverse federal state, carbon pricing as suggested by the government of Canada is sure to have an effect on the economy with varying results across the country. The aim of this study is to outline the varying effects carbon pricing has had based on mechanism used and the sectors that were targeted in other jurisdictions. Using this it aims to provide tools that could be used in the future by the federal government in order to ensure unified compliance with its 2030 emissions goals set forth in the Paris Agreement. It will also use this forum as an opportunity to outline some of the challenges that the current federal state can potentially face.

2.2. Conceptual Frameworks

As a mixed-methods study, it will work to incorporate both quantitative and qualitative approaches in order to extrapolate results and apply them to Canada. It will analyse the environmental impact of jurisdictions quantitatively through The IPAT (Environmental Impact as a factor of Population, Affinity, and Technology) formula. This formula suggests that the environmental impact of a country is a function of population size, wealth, and technology (Franzen & Mader, 2016). The formula was first introduced by Ehrlich and Holdren (1971) and was expanded by Dietz and Rosa (1997) into the STIRPAT (Stochastic Impacts by Regression on Population, Affluence, and Technology). Using the principles that have been pioneered by these authors, empirical analyses seeking to understand the factors that influence energy consumption or emissions at a cross-national level employ this formula often. Liddle (2014) finds that of the 28 papers he surveyed between the years of 2010-2013 that seek to understand the relationship, over half utilize this formula as the basis of their empirical analysis. The use of the formula has remained prominent since this time. Recently it has been used by the likes of Franzen and Mader (2016) who have used it to study the prominence of international commitments, and Fernández-Amador, François, and Tomberger (2016) who study the effects of international trade on emissions.

From a qualitative perspective, this study will use the lens provided by the concept of path dependency and carbon lock-ins. These interdependent frameworks will allow us to assess the current environmental, political, and jurisdictional paths that Canada has set itself up upon while providing an outlook on any changes coming as a

result of The Framework. Thelen (1999) highlights two viewpoints on path dependency in her work. The author suggests that path dependency can be viewed through the technological model derived from economics and through an Institutional Sociology lens. The first places focus on firms and products, stating that certain technologies for unpredictable reasons hold advantages over alternative technologies available. This leads firms and users to adopt the widely accepted technology in order to adapt to the new technologies and thus creates an environment in which "actors adapt to prevailing institutions by investing in them in ways that reinforce the institutions" (Thelen, 1999, p. 385).

Institutional Sociology shifts the focus to collective outcomes, with more focus placed on institutions as a constructed embodiment of shared cultural understandings (Thelen, 1999). The author also places further focus on two mechanisms within path dependence: critical junctures and feedback effects. The first refers to founding moments of institutional formation that set different institutions on their respective paths. Within these paths, scholars have identified that the sequence in which events occur and their timing work as key influences by holding the potential to affect policy both between policy realms and across nations (Thelen, 1999). Thelen's second mechanism, feedback effects, is identified as stable patterns in politics that tend to follow established processes that allow themselves to reproduce over time (1999). However, this does not force institutions into an environment where they cannot change. Thelen also states that institutions are built on a set of ideational and material foundations that, if disturbed, open them up to the possibility of change.

The concepts introduced by Thelen were further developed by Pierson (2000) who dives into further features that were observed within paths. The author outlines four features that work within political life in order to foster path dependency and offer increasing returns for maintaining that path. Similar to the ideas proposed by Thelen, Pierson defines these increasing returns present as "self-reinforcing or positive feedback processes" (2000, p. 251) that increase the cost of switching from one alternative to another and distinguish formative moments from phases reinforcing divergent paths. The features discussed by the authors are as follows: i) Multiple Equilibria: under the initial condition, a number of outcomes are possible; ii) Contingency: small events at the right moment can have large enduring consequences; iii) Critical role for timing and sequencing: when an event occurs is crucial, if the event is too late it may have no effect

in contrast to an earlier occurrence that would allow it to shape the path; and iv) Inertia: once a process of increasing returns is entrenched, positive feedback creates a single equilibrium that is resistant to change (Pierson, 2000, p. 263). The observations made by Thelen and Pierson suggest that any shifts in policy will come at a cost that are associated with a break from both technological and sociological path dependencies that can exist in that policy realm, which in the case of carbon pricing holds the potential to influence multiple policy realms. Furthermore, if the policy is successful in establishing a new path, these new policies hold the potential to influence changes in other policy realms that can be difficult to predict.

Unruh provides us with insights into both technological and institutional lock-ins and suggests processes through which changes within this realm can occur. In his work Unruh (2000) coins the term carbon lock-in. The author describes the concept as the tendency that industrial economies show to being locked into fossil fuel-based technological systems through path-dependent processes that are driven by technological and institutional increasing returns to scale. The technological aspect refers to the “inter-related components connected in a network or infrastructure that includes physical, social and informational elements” (p. 819). In regards to carbon pricing strategies, this could include but not be limited to: energy production methods, transportation systems (cars, roadways, and service stations), infrastructure, and more that are maintained by a mix of private and public institutions. Private institutions evolve in conjunction with technologies, resulting in positive feedback to the lock-in through the emergence of non-market forces such as coalition building, voluntary association and the emergence of societal norms and customs (Unruh, 2000). The author also outlines that public institutions are not immune to the influences of technological lock-ins. First, formal public institutions follow the momentum that is created by the emergence of an interdependent technological system and contribute to the lock in by becoming directly involved. Second, once these public institutions become involved they tend to further exasperate the issue by becoming locked in and becoming subject to their own path dependency followed by long periods of incremental change (Unruh, 2000). According to Unruh there are methods through which these lock-ins can be discontinued.

In a later study, Unruh (2002) suggests that there are three policy approaches through which a current system can be modified while minimizing social disruption and mitigating technologies lock-ins in favour of more environmentally friendly methods. The

first approach requires no changes to the system but tackling emissions directly; the second requires adjustments to select components or processes, and the third, a complete overhaul of the system (p. 318). Where Canada's policy direction sits remains to be seen, but it is not unfathomable to contemplate that policies that fall in all three of the directions suggested by the author can occur as a result of The Framework at a micro level. However, the current methods suggest a combination of the first two are already occurring across the country. These exemplify attempts to ease transitions towards a new technology while encouraging what the author coins as continuity, an incremental innovation or change with a focus on components or intra-system innovation (p. 318) while attempting to deal with emissions directly.

2.3. Limitations

The most prominent limitation in this study is the selection of cases. The sheer number of cases that could have been used for this is immense. This also holds the potential of providing results that would be difficult to apply into the Canadian context as the experience would have to be similar to the country. The cases selected here provide long term data that is reported from reliable sources and hold consistency between sources. Some of the other cases that could have been selected do not have as much long term data available due to their recent implementation or are missing data. To further add to this issue, there are multiple types of complimentary policies that are the subject of experimentation in other jurisdictions. The policies that have been or are being implemented in the jurisdictions mentioned are similar to those outlined in the Framework in Canada. As such, cases outside of those selected would limit the amount of inferences we can make on potential implementation in the country.

Second are the limitations placed on time frames being studied. This project looks at specific time frames, starting in 1991, where either ETS or CT have been implemented with some overlap that has been controlled for, details of these time frames can be found in Table 1. Doing this allows us to infer results from each of these jurisdictions in combination with pricing strategy used. This ensures that the inferences made can be attributed to one mechanism, the other, or a combination of the two with a good amount of confidence. The time frames selected are also similar for all cases, this allows for similarities in external factors (e.g. market conditions, international attitudes

etc.) that would affect each jurisdiction further increasing the confidence that can be inferred from the results.

The final limitation comes in the form of data available. Although the majority of data did exist for all the variables tested in this study, the most complete information ends in 2014. As such, this is the most recent year that is represented in this study. As much of a welcome challenge filling the data up to 2016 for all variables would be, the time and preciseness that is required is beyond the scope of this project and my expertise.

Chapter 3.

Comparative Case Studies

The following chapter will provide the quantitative analysis of the applications of ETS and CT in the selected cases. The analysis of the data will be done on two levels. The first will be at a country level and the second will be at a year to year level. This will allow the data to embody overall effects of the year to year changes and the countries in which they take place allowing us to visualize the overall relationship between factors that influence emissions. This will be followed by the overall trends in the cases for the time frames in which the mechanisms in question existed and continue to exist. The relationships tested will follow the IPAT formula, as outlined in the Theoretical Frameworks section earlier. The variables that will represent the influence of population size, wealth and technologies, along with the sources of the data are outlined below.

3.1. Data Sources and Variables

The data set used in this study was extracted and compiled through the January 2017 version of the Quality of Governance time series data set (Teorell, et al., 2017) with some missing and additional information added through The World Bank's Open Data by the indicator in question (World Bank, 2017b), given that the measures were calculated in the same manner. The data was split into three sections: the first consists of the time frame for CTs using Norway and Denmark, the second was compiled for the EU ETS analysis and consists of all 31 participating countries and within the timeframe of discussion, and the last portion reverts back to the Norway and Denmark discussion by extracting just those two countries with both CTs and ETS mechanisms in place.

3.1.1. Per Capita CO^2 emissions

The dependent variable of this study, is defined by the compilers of the QoG dataset as emissions per capita resulting from "the burning of fossil fuels and the manufacture of cement…include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring" (Teorell, et al., 2017, p. 611). Some countries were missing information from this variable from the QoG dataset for the years 2012-2014 and

this information was filled from The World Bank's data indicator (2017c). As per Cutlip and Fath, per capita emissions are a "good indicator of development" and provide a better understanding of emissions while controlling for a group of countries whose populations vary widely (2012, pp. 435-436). As these same variations exist in the countries used in this study, this variable should provide insight into the development level. Furthermore, Franzen and Mader established that there is a proportional relation between the size of a country's population and its CO^2 emissions, thus emissions per capita provides a more accurate picture as a dependent variable (2016, p. 502). CO^2 has also been the target greenhouse gas (GHG) for reduction for the longest time period within the ETS (European Commission, 2016a) and is the measure of the goals for Canada, as such, those countries with effective environmental policies should display lower emissions of this gas. Although Per Capita emissions is not the exact measure used by the countries in the Paris Agreement, this study assumes that changes in this value leads to an overall change in the total emissions per country.

3.1.2. Gross Domestic Product (GDP) Per Capita

As mentioned above, the IPAT formula suggests that the environmental impact of a country is a function of population size, wealth, and technology. Franzen & Mader's replication experiment using this formula reinforces this assertion as the findings suggest that "(a)s energy intensity increases by 1 % per GDP of output (measuring higher inefficiency) CO^2 emissions increase by 0.31 %" (2016, p. 494). As such GDP per capita merits use as a control variable in order to ensure that this relationship is accounted for in the models created. This data was not available past 2012 on the QoG Data Set and was reported differently in The World Data Bank Indicator. In order to maintain consistency, the measure used in this study was extracted from The World Bank and are reported in constant 2010 United States Dollars (World Bank, 2017d).

3.1.3. Economic Globalization

Globalization and increasing trade liberalization has forced carbon emissions to gain importance in the studies within this realm. Between 1997 and 2011, this increase in trade has been embodied by a 50% increase in the carbon emissions that are credited to international trade (Fernández-Amador, Francois, & Tomberger, 2016, p. 22). In order to control for this relationship between these two variables, this variable from the QoG

has been added to models in this study. The variable utilizes the KOF (Swiss Economic Institute) Index of Globalization and ranges between 0 and 100 with higher values representing higher globalization (Teorell, et al., 2017, p. 175).

3.1.4. Economic Growth Per Capita, Renewable Energy Production, Renewable Energy Consumption, Fossil Fuel Consumption

Cutlip and Fath outline that a country's carbon emissions are a result of the specific economic and developmental state of the country at the time of analysis including the energy sources that are used into order to drive this development (2012, p. 435). Other studies have however established a relationship between these factors in a different time frame. For example, Huang, Lee, & Wu (2008) find in their study that between 1988–1991, the GDP of Poland decreased by 20% and carbon dioxide emissions also decreased 22%. This stresses the need to control for the economic growth that is being experienced by the countries in this study, represented by GDP per capita. This is also present in this study, as for all models ran including the year 2008, the global recession at the time looks to have this same effect. Also, as "the amount of fossil fuel consumed by the people in a country must be decreased in order for carbon emissions to decline" (p. 436) fossil fuel consumption should also be controlled for in order to assess its effect. Controlling for the production of renewable energies, percentage of total electricity production through renewable methods, and overall fossil fuel consumption allows this study to control for the likely variation in energy mixes, technologies used, and consumption levels within the sample. For all of the variables in this section, data was missing from 2012-2014 for some countries. As such, these were all filled in from The World Bank indicators database (World Bank, 2017b).

3.1.5. Carbon Taxes

Despite best efforts to limit the interaction of the two mechanisms, there are a significant number of jurisdictions within the EU ETS that chose to implement a carbon tax within the time frame being studied. This study creates a dummy variable in order to control for the effects of the existence of the CT within the jurisdiction in the year being represented in the model. As both these methods are designed to mitigate emissions, creating these variables will allow us to effectively predict and distinguish the effects this has had on CO^2 emissions and separate this from the effects of the ETS. The variable

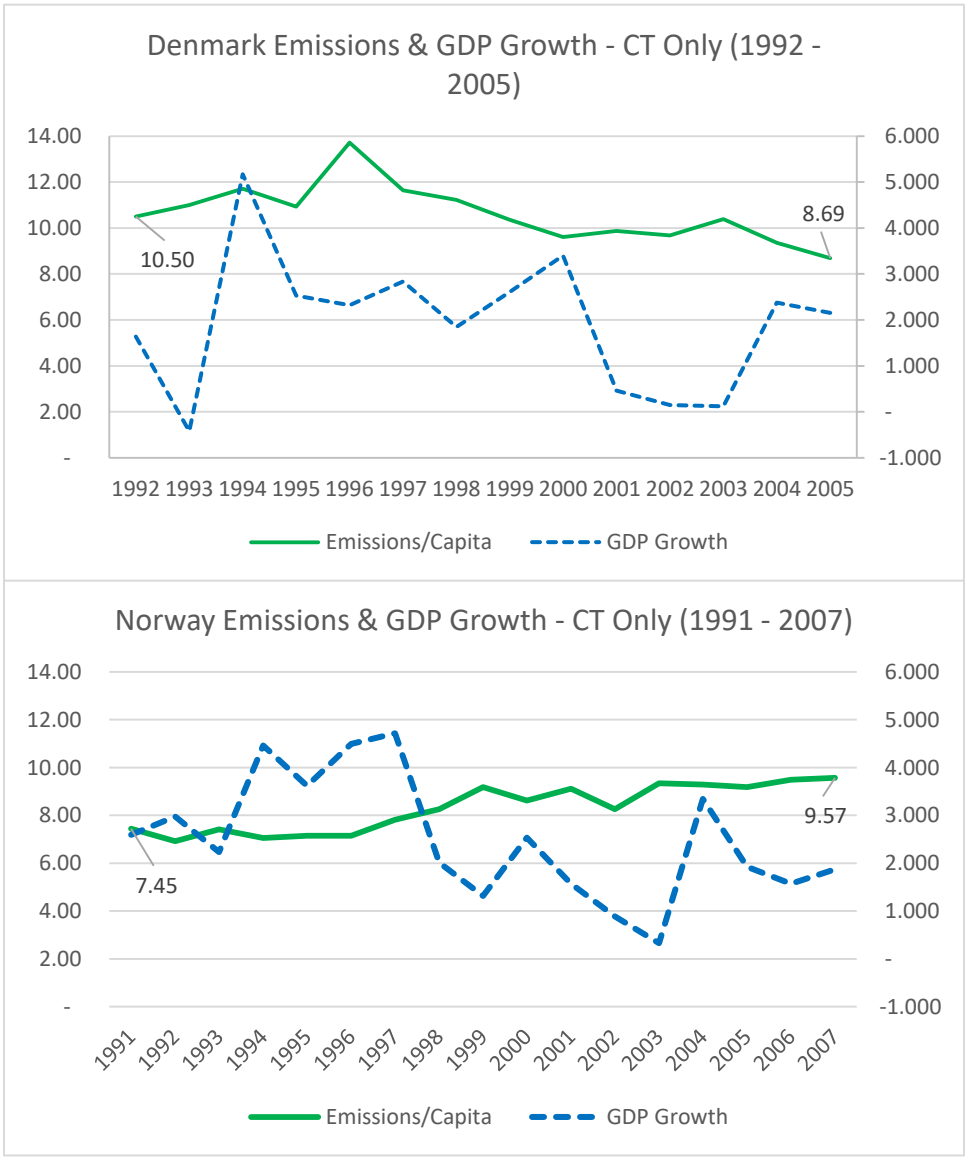
was filled in as “1” for countries and years that they implemented a CT based on the World Bank’s State and Trends of Carbon Pricing report (World Bank, 2016).

3.2. Results and Trends

3.2.1. Carbon Taxes

We begin with jurisdictions that applied only Carbon Taxes, the older of the two mechanisms that are the subjects of this study. The overall trends in Emissions Per Capita and GDP Growth Per Capita outlined in Figure 2 below show that the mechanism had diverging effects on emissions within the jurisdictions. Although the mechanism was applied and existed in insolation for a similar time frame in both cases, Denmark saw a slight overall reduction in Per Capita Emissions while Norway saw an increase in emissions. It is imperative to note that although there was divergent results in emissions, the year to year change in GDP Growth Per Capita between the two countries remained similar. This would suggest that there are further factors that influence changes in emissions Per Capita, which are to be studied in the regressions presented in Table 2 below.

Figure 2 – Overall Emissions and GDP Growth Denmark VS Norway (CT)



The regressions for the CT cases in this study continue to produce curious results. When analyzing Emissions Per Capita at a country level we see that Denmark holds a negative relationship between the dependent variable and Economic Globalization, while the relationship is opposite for Norway. GDP Per Capita, one of the three statistically significant variables, also shows the same relationship change between countries. With both countries combined, in order to assess the overall effect of CTs in the region, this looks to be a positive relationship with Emissions Per Capita, however this changes to a negative relationship for Denmark and remains a positive one

for Norway. This relationship, however, has a minor effect on Emissions per Capita. Renewable Energy and Fossil Fuel consumption are both statistically significant for both jurisdictions and displays a positive relationship at a country level as well.

Table 2 – Regression models for Carbon Tax jurisdictions

	Emissions Per Capita		
	Model 1: Denmark and Norway	**Model 2: Denmark**	**Model 3: Norway**
Economic Globalization	-0.030 (0.024)	-0.040 (0.069)	0.010 (0.033)
GDP Per Capita	**0.0001*** (0.00001)**	-0.0001 (0.0001)	**0.0001*** (0.00002)**
Renewable Energy Production	-0.072 (0.043)	0.095 (0.148)	-0.586 (1.334)
Renewable Energy Consumption	**0.184** (0.080)**	0.097 (0.253)	0.113 (0.136)
Fossil Fuel Consumption	**0.329*** (0.042)**	**0.448*** (0.063)**	**0.203* (0.092)**
GDP Growth Per Capita	-0.023 (0.046)	-0.016 (0.051)	-0.115 (0.097)
Constant		-25.146*** (4.792)	43.115 (128.573)
Observations	31	14	17
R^2	0.936	0.980	0.927
Adjusted R^2	0.916	0.962	0.884
Residual Std. Error		0.243 (df = 7)	0.333 (df = 10)
F Statistic	55.733*** (df = 6; 23)	56.093*** (df = 6; 7)	21.304*** (df = 6; 10)

Note: *p<0.1; **p<0.05; ***p<0.01

As can be seen from the Figure 2 above, Denmark and Norway yielded different results from their respective CTs, with Denmark seeing a reduction in Emissions Per Capita and Norway experiencing an increase in emissions. During this time frame, there were three points of difference between the two jurisdictions as outlined in Table 1. Denmark had a lower overall tax rate, while taxing a large number of sources and used the revenues for recycling in combination with investing in environmental goals. By contrast Norway had a lower starting tax rate that rose to be higher than Denmark, and taxed specific sectors. Initially, Norway also did not recycle the revenue raised and did not directly invest in green technologies until a later time. The results from these jurisdictions do not offer us any conclusive evidence that CTs were efficient in reducing the emissions for either case.

3.2.2. Emissions Trading Systems

The theme of results differing by jurisdiction continues when we shift time frames and look at the jurisdictions studied for ETS jurisdictions. At a bird's eye view, we see that the analysis of the EU ETS in Table 3 below yields statistically significant results for GDP per Capita, Fossil Fuel Consumption, GDP Growth Per Capita, and the presence of a Carbon Tax. However the minor positive effect of GDP per capita becomes negative for Ireland and Spain combined and for Spain on its own while remaining a positive one for Ireland. We also see a more significant effect of GDP growth at a country level than at a large scale level with the EU. The results also show that CTs within the EU ETS have a significant and negative effect on Emissions Per Capita. This is a vital relationship to identify as it displays that the mechanisms can work together and provide further reductions. As Figure 3 below shows, the EU ETS overall has seen a reduction of Per Capita Emissions. The relationship between economic growth and emissions for the system, however, appears to be more independent of each other in contrast to Denmark and Norway under a CT system.

Figure 3 – EU ETS Average Emissions and GDP Growth (includes ETS and CT)

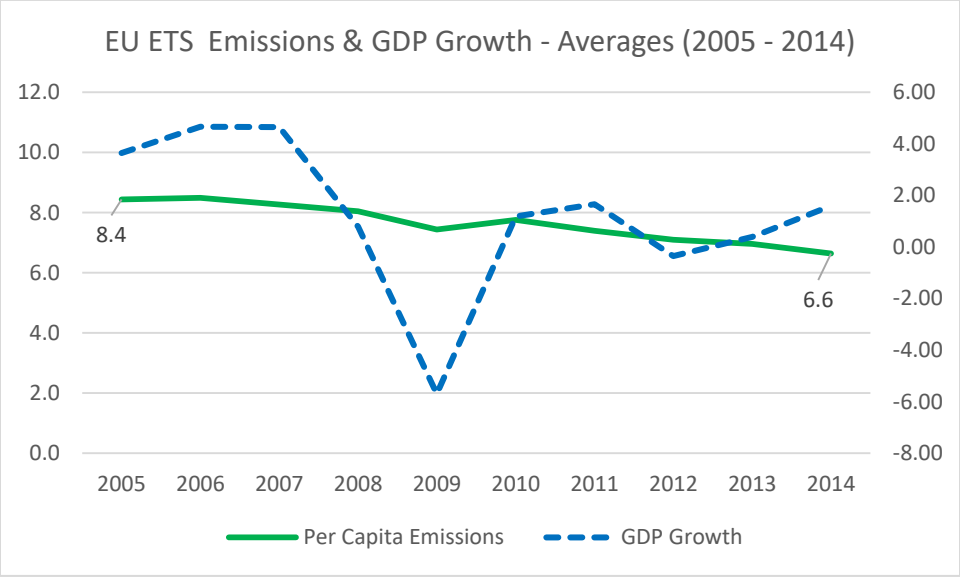
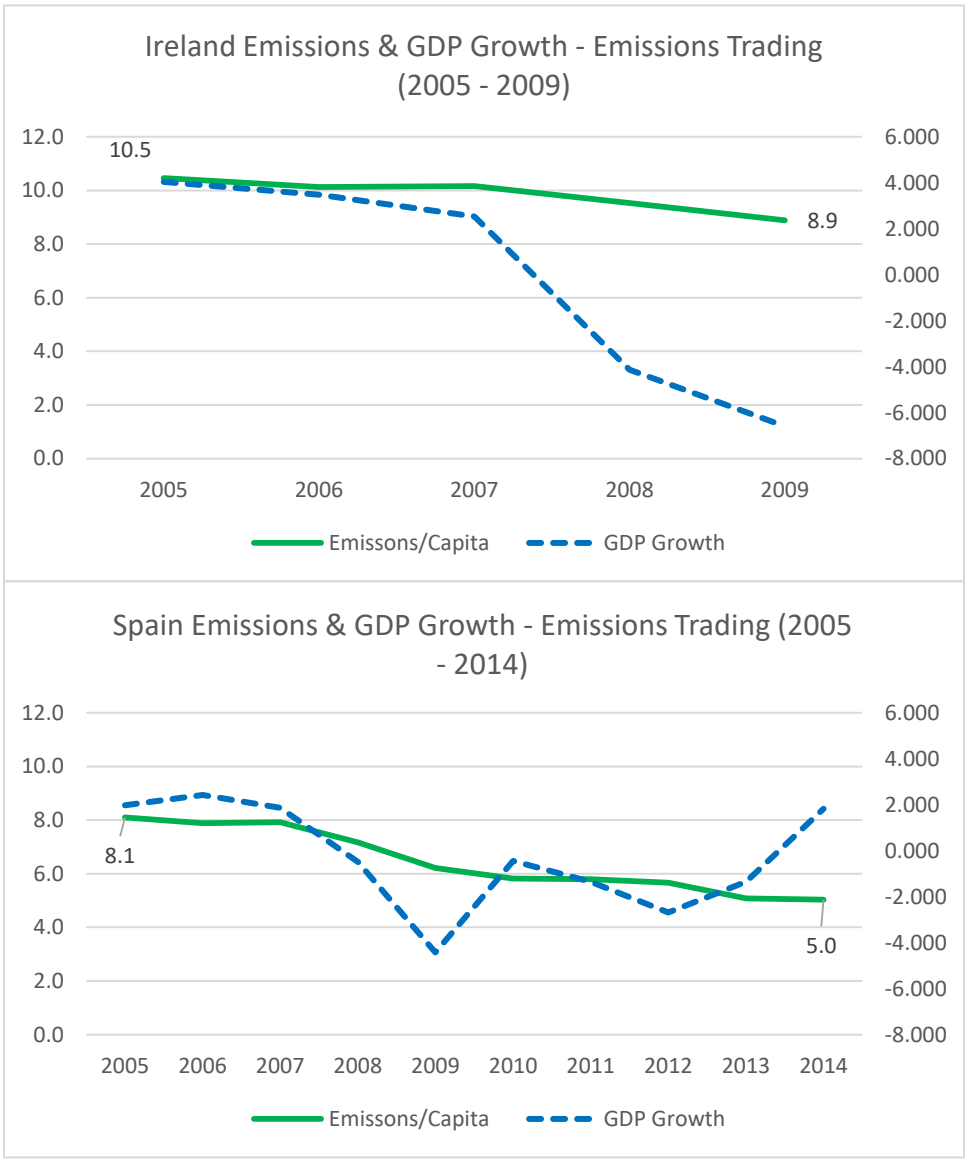


Figure 4 below compares and contrasts the same relationship between Ireland and Spain. For the small amount of time Ireland was studied under just an ETS, under Phase I of the EU ETS, it showed reduction in emissions. As per the details outlined in Table 1, during this time the jurisdiction utilized the revenues gathered from this into

general funds for the country. The emissions reduction in Ireland, however, appears to be more directly tied to GDP Growth per Capita. Although an attempt was made to study this relationship for the country, the lack of observations did not yield concrete quantitative evidence and as such cannot be asserted. Further case analysis needs to be undertaken for this jurisdiction in order to prove this relationship but is beyond the scope of this study.

Figure 4 – Overall Emissions and GDP Growth Ireland VS Spain (ETS)



An ETS in Spain between 2005-2014 (under Phase I and II of the EU ETS) also displays good results in terms of emission reductions. Spain has reported that it has

used all of the revenue generated from the system into climate and energy related measures in order to reduce emissions for the jurisdiction (Carl & Fedor, 2016). This approach appears to be allowing Spain to reduce its emissions at a rate of 0.31/year for the time frame studied. Although impressive, this is similar to the rate Ireland experienced between 2005-2009, at a reduction of 0.32/year.[3] Overall, the EU ETS seems to be yielding results in terms of emissions reductions for the jurisdictions reviewed by this study.

Regression analysis of this mechanism does not produce statistically significant results for the two cases studied, outside of outlining that GDP Growth Per Capita has a positive relationship in the case of the countries combined. It does provide some valuable insight into the EU ETS as a whole. The models show a positive relationship between Emissions Per Capita and GDP Per Capita, Fossil Fuel Consumption, and GDP Growth Per Capita. It also outlines two negative relationships, Renewable Energy Production and the Presence of a CT. The latter of the two being an imperative finding as it outlines the possibility of coexistence and the potential to yield further decreases in emissions than just one mechanism alone, the results of this coexistence is discussed in the section following.

[3] Calculated by author using the change in emissions per capita and number of years.

Table 3 – Regression models for Emissions Trading jurisdictions

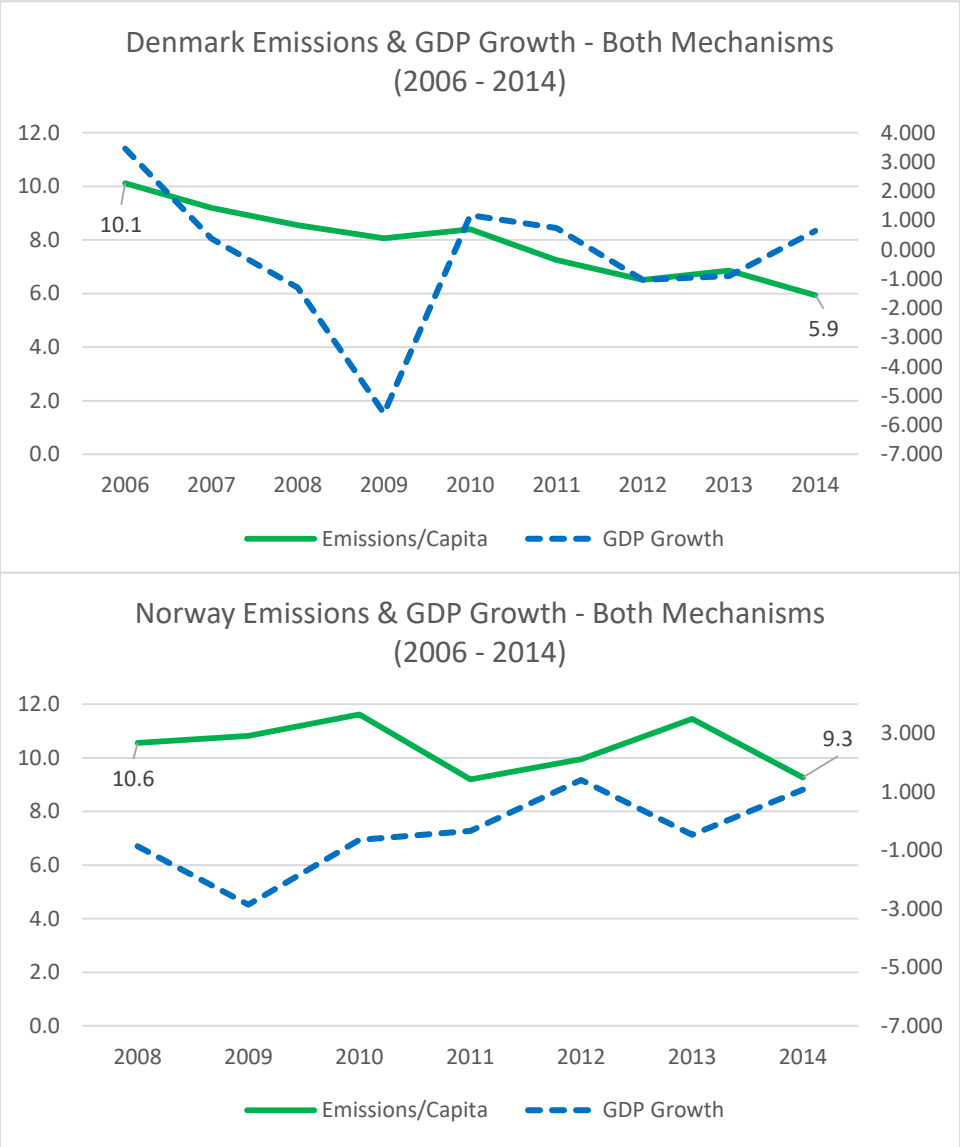
	Emissions Per Capita				
	Model 1: EU ETS	**Model 2: EU ETS with CT**	**Model 3: Ireland and Spain**	**Model 4: Ireland**	**Model 5: Spain**
Economic Globalization	0.024 (0.020)	0.022 (0.020)	-0.019 (0.058)	-7.937	-0.060 (0.084)
GDP Per Capita	**0.0001*** (0.00003)**	**0.0001*** (0.00003)**	-0.0001 (0.0001)	0.001	-0.0001 (0.0001)
Renewable Energy Production	**-0.044*** (0.011)**	**-0.047*** (0.011)**	-0.031 (0.025)	-20.392	-0.048 (0.029)
Renewable Energy Consumption	-0.012 (0.028)	0.001 (0.028)	-0.015 (0.156)	59.836	0.124 (0.169)
Fossil Fuel Consumption	**0.089*** (0.017)**	**0.088*** (0.017)**	0.198 (0.156)		0.274 (0.154)
GDP Growth Per Capita	**0.022** (0.010)**	**0.026** (0.010)**	**0.116** (0.038)**		0.174* (0.050)
CT		**-0.551** (0.255)**			
Constant				678.844	-8.683 (10.788)
Observations	270	270	14	5	9
R^2	0.547	0.556	0.990	1.000	0.996
Adjusted R^2	0.480	0.488	0.977		0.986
Residual Std. Error					0.138 (df = 2)
F Statistic	47.180*** (df = 6; 234)	41.738*** (df = 7; 233)	94.994*** (df = 6; 6)		92.425** (df = 6; 2)

Note: *p<0.1; **p<0.05; ***p<0.01

3.2.3. Both Mechanisms

Results for the existence of both mechanisms continue the theme of results differing based on jurisdiction. The regression models were created for Denmark and Norway together, one for each jurisdiction separately and for all EU ETS countries that employed both carbon pricing mechanisms. Most of the results that are statistically significant are present in Model 4 that utilizes all EU ETS Countries to measure the relationship of the variables in this study. However, this should not discourage analysis of the type of relationship that exists within the jurisdictions studied. The positive and negative relationships between variables stay mostly consistent between all models with the exception of Economic Globalization and Fossil Fuel Consumption. The extent to which these affect Emissions Per Capita, however, differs between jurisdictions and mechanisms. For example, Renewable Energy Production at an EU ETS level has a negative relationship with Emissions Per Capita but the effects of this are more prominent in Denmark and Norway. Overall, the combination of ETS and CTs that are present seems to be providing results in terms of pure Per Capita emissions reductions (see Figure 3). The reductions that are seen in Denmark and Norway with the use of both mechanism however differ greatly.

Figure 5 – Overall Emissions and GDP Growth Denmark VS Norway (Both Mechanisms)



As Figure 5 shows, the overall reduction of Emissions Per Capita that has been achieved by Denmark outpaces that of Norway. Utilizing both mechanisms Norway has seen a reduction of 0.19/year while Denmark has seen a reduction of 0.47/year.[4] Norway does see a sharp decline between the years of 2013-2014, this is the time when Norway announced that it would utilize the increase that it applied to its existing CT to green spending and further their revenue recycling. Due to the lack of data for the

[4] Calculated by author using the change in emissions per capita and number of years.

following years, further effects of this decision could not be analyzed but does provide itself as a positive change for the jurisdiction.

Table 4 – Regression models for Both Mechanism jurisdictions

	Emissions Per Capita			
	Model 1: Denmark and Norway	**Model 2: Denmark**	**Model 3: Norway**	**Model 4: All EU ETS Countries**
Economic Globalization	0.001 (0.105)	0.129 (0.150)	-0.308	0.016 (0.032)
GDP Per Capita	0.0001 (0.0001)	0.0001 (0.0001)	0.001	**0.0001*** (0.00001)**
Renewable Energy Production	-0.029 (0.122)	-0.173 (0.104)	-2.217	**-0.123*** (0.026)**
Renewable Energy Consumption	0.264 (0.278)	0.513 (0.343)	3.015	0.036 (0.052)
Fossil Fuel Consumption	**0.379*** (0.072)**	0.267 (0.190)	0.392	**-0.083*** (0.021)**
GDP Growth Per Capita	0.022 (0.053)	0.036 (0.059)		0.043* (0.024)
Constant		-32.038 (27.152)	5.113	12.466*** (3.346)
Observations	14	8	6	45
R^2	0.947	0.997	1.000	0.950
Adjusted R^2	0.885	0.980		0.942
Residual Std. Error		0.173 (df = 1)		0.832 (df = 38)
F Statistic	17.822*** (df = 6; 6)	57.271 (df = 6; 1)		119.950*** (df = 6; 38)

Note: *p<0.1; **p<0.05; ***p<0.01

3.2.4. Conclusion and "Rays of Sunshine"

Upon reviewing the results and relationships in the cases analyzed in this study, we can conclude that when it comes to carbon pricing, it truly is an "it depends" answer. We find that emissions were reduced in some cases but not all when it comes to an application of just CTs. With the use of ETS and a combination of the two mechanisms, there are reductions but with variations in the degree to which they were reduced. However, as there are a large number of factors that influence emissions in a jurisdiction, there is a potential that there are missing variables in this study. The results and trends with the factors used, dictate that based on the structure of the pricing mechanism, price level, use of revenue, sector, and the jurisdiction studied outcomes as well as relationships of influential variables fluctuate. While the jurisdictions mentioned failed to meet the promised targets outlined in the Kyoto Protocol, the guiding international agreement in place for a majority of the timeline analyzed in this study, it

does not imply that its influence has been completely unsuccessful. As Aichele & Felbermayr (2013) outline in their study, the presence of the Protocol worked as an incentive for jurisdictions to lower their emissions. In some cases this has resulted in further reductions than others but in all cases they provide policy lessons Canada can utilize in order to shape its own path in using carbon pricing to reduce emissions. Given the intricacies and variations in emissions reductions coming as a result of previous implementations, Canada as a whole must be cognitive in its trajectory if it wants to meet the targets sets forth in the Paris Agreement.

Although the findings of this study are jurisdiction specific, the set of circumstances that exist within these studies provide some guidance. The case studies show the targeted sectors can cause a change in the reduction seen by a jurisdiction. It also shows that a combination of the two mechanisms, with revenue recycling and reinvestment into green technologies, yields the most potential for reducing emissions. This would require action that extends beyond what the Framework currently outlines with carbon pricing implemented by the provinces and other “complimentary” policies (such as policies encouraging: investment in sustainable energy production, building, and transportation) that are yet to be fully determined. If Canada wants to avoid inconsistent results across the country and reduce its chances of withdrawing from the Paris Agreement like it did with the Kyoto Protocol, the federal government of Canada must set a direction for the provinces that will allow them to individually work towards a unified goal that should be dictated at the federal level. This direction should include a combination of the two pricing mechanisms across-Canada.

The largest challenge here for Canada lies in the question of jurisdiction. As outlined earlier in this study, Canada has inherited a quite complex set of environmental, political, and jurisdictional circumstances that the federal government must navigate in order to ensure that it does not overstep its authority. The environmental and political circumstances are significant and recently have shifted in favour of supporting a more aggressive stance on carbon emission mitigation. In order to further a nation-wide and unified agenda the federal government must take more action than it currently has in order to ensure that all provinces and territories are working in conjunction with each other to meet the goals set forth in the Paris Agreement. The following section will work to provide a more detailed jurisdictional review in order to ascertain what options, if any, the federal government has to implement a nation-wide carbon pricing scheme.

Chapter 4.

Canadian Context

To simply state that the Canadian Federal-Provincial split in jurisdiction is complicated may be doing the current system a disservice. The evolution, in practise, of the jurisdictional separation of powers from Confederation in 1867 to today has been remarkable, especially for a jurisdiction such as the environment that was not specifically assigned to an order of government (Government of Canada, 2010a). As such, jurisdiction for environmental authority has been scattered throughout many broader subjects of power. In this review of jurisdictional separation, this study will explore five subjects under which powers are separated: taxing powers, resource development, trade and commerce, health and safety, and international treaties. This review will include the parameters of the powers afforded to the federal government under the "Peace, Order, and Good Government" clause and the potential it holds to settle any jurisdictional fragmentation.

First, we outline the capacities of both levels of government to raise revenue through taxation. In accordance to the Constitution Act, Section 91(3) the legislative powers surrounding raising revenue by any mode or system of taxation falls within the power of the Parliament of Canada (Government of Canada, 2017c). Section 92(2) under the Act also states provincial legislatures are limited to: "Direct Taxation within the Province in order to the raising of a Revenue for Provincial Purposes" (Government of Canada, 2017c). These sections simply and effectively outline the taxation powers of each level of government. This separation of legislative powers allow the provinces the capacity to only impose direct taxes to citizens within the provincial boundaries, while the federal government enjoys the capacity to legislate direct and indirect taxes nationwide.

The second subject of review concerns resource development. In accordance to Section 92 of the Constitution Act, there are two matters that are expressly assigned to the authority of the provinces:

Table 5 – Jurisdiction over environmental issues exclusively assigned to provinces (Government of Canada, 2017c; Backlumb, 2013)

Section	Interpretation
(5) The Management and Sale of the Public Lands belonging to the Province and of the Timber and Wood thereon.	Empowers provinces to regulate activities surrounding natural resources such as mining and lumbering on their substantial Landholdings.
(13) Property and Civil Rights in the Province	Empowers provinces to regulate most types of business and industrial activities, including emissions from such activities

These sections have led to the assumption of provincial jurisdiction over dealings with natural resources and their development along with of GHG emissions as they pertain to most types of buildings, businesses, industries and intra-provincial transportation (Backlumb, 2013). The decentralizing nature of these are compounded by what Weibust (2010) claims are a lack of provisions that would allow the federal government to act on behalf of a province if that province is failing to protect the environment, and the delegation of the provision of the few federal laws that are in place to the provinces (p. 217).

Jurisdiction over trade and commerce is outlined in Section 91 (2) of the Constitution Act as the sole responsibility of the federal government (Government of Canada, 2017c). As this power is not limited through provincial/territorial boundaries and are not limited to specific industries, it can be presumed that the federal government can use this to legislate carbon pricing in the realm. A separate area where the federal government holds sole authority is covered under section 91 (27), which establishes federal authority in terms of Criminal Law (Government of Canada, 2017c). This section provides the federal government sole authority to regulate the toxic substances present within Canadian borders that are a risk to health and safety (Backlumb, 2013). Although, the application of this authority to a carbon pricing scheme is unclear. In all likelihood, this section will only apply to the management of toxic substances within emissions rather than a carbon pricing mechanism specifically.

The final area of review regarding the jurisdictional powers concerns the ability to negotiate international treaties. Section 132 of the Constitution Act, provides the Government of Canada with all powers that are deemed necessary and proper for negotiating treaties on behalf of the country and its provinces (Government of Canada, 2017c). This, however, does not give the federal government the authority to enact these

agreements unilaterally within the country. The legislative separation of powers that are set forth in Sections 91 and 92 of the Constitution Act, outlining the responsibilities of federal and provincial government, must be respected. As such, although provincial consent is not required for Canada to sign an international treaty, the federal government does consult with provinces and territories regarding issues that touch their jurisdiction and ultimately leaves their implementation to the respective bodies (Barnett, 2012).

Despite strict separation of powers, the federal government still holds a trump card provided by the Constitution Act. Section 91 of the act allows the Government of Canada the ability to implement laws for the Peace, Order, and good Government (POGG) of Canada (Government of Canada, 2017c). As Simeon and Nugent (2012) outline, the federal government was given this sweeping power to disallow provincial legislations as it sees fit. Within the environmental realm, a significant case outlining this would be that of R. v. Crown Zellerbach Canada Ltd. Here the Supreme Court of Canada decided to allow the federal government to intervene over the environment as this was a matter of national concern (Baier, 2012). This decision is particularly important, specifically in the environmental realm as it holds the potential to allow the federal government to pass laws within the realm if it is deemed to be a matter that has national consequences.

From a separation of powers perspective, the arrangement of legislative powers dictates that the environment is an area of shared jurisdiction between the two levels of government. In addition to this, Canadian courts have decided that due to the likelihood of pollution crossing borders the authority to act upon it is held by both levels of government (Winfield & Macdonald, 2012). However, the breadth of the powers that the federal government holds, including its spending power gives it the edge on the authority it holds over the policy realm. Three specific aspects of jurisdictional separation that can help illustrate this are Sections 91 (3), (27), and (127). These three sections allow the federal government the authority to unilaterally tax as it deems to be in the best interest of Canada, the authority over criminal law, and to act on Canada's behalf when negotiating international treaties. As such, this study will proceed under the assumption that the federal government could implement a federal carbon pricing program if it chooses to do so.

The potential application of these sections cannot be fully confirmed outside the courts. If emissions levels, more specifically their level of toxicity, are justified to be harmful enough, the Supreme Court's 1997 decision allowing the exercise of federal authority here to create criminal laws (Backlumb, 2013) could allow an avenue through which the federal government can implement a national carbon pricing scheme. This would be reinforced with Section 91 (3) and works doubly to allow Canada to use Section 91 (127) as well to highlight that it has a commitment at a national level to meet the agreements that it has signed. Furthermore, the POGG powers allowed by the courts to the federal government, specifically the R. v. Crown Zellerbach Canada Ltd. decision, would justify federal intervention in the environmental realm as a matter of national concern. Given the powers that these sections and provisions allow the federal government, this review concludes that the Government of Canada would be fully justified to act on behalf of provinces and territories, and in the nation's interest to implement a carbon pricing mechanism that it sees fit to meet its international commitments and in protecting Canadians.

Despite the federal government's ability to assume authority and implement a national carbon pricing system in conjunction with what it has required of the provinces in the Framework, it does not make it the best course of action. Canada is a resource-based economy with just under 30% of our 2016 GDP[5] based in Goods-producing industries (Statistics Canada, 2017), not including service-producing industries that work in conjunction with these. Studies of countries reaching voluntary reduction levels for the Paris Agreement are lacking; however Lim (2011) proposes models that offer scenarios in which major countries achieve their Post-Kyoto reductions goals. These models predict that the overall GDP would drop by 1.5%, with Canada dropping by 1.3-1.4%. As the goals for the Paris Agreement are more aggressive than that of Kyoto, we can presume that the effects of a federal and unilateral strategy to meet those goals would cause a more significant drop for the country's GDP and cause backlash for the federal government.

The concepts of Path Dependency and Carbon Lock-ins can allow us to identify other instances from which these backlashes and costs of switching to an alternative policy direction with a focus on emissions reduction can occur. It is important to note

[5] Calculated by author with information from Statistics Canada.

that, as future costs can be difficult to predict quantitatively, this study will classify costs as legal and political ones that can be incurred by the federal government with actions taken that stray from the current policy path. The first source of resistance is the resource-based nature of the Canadian economy outlined above. The second would be the cost of restructuring existing institutions, as Unruh (2000) outlines, carbon lock-ins refer to the concept of industrial economies being locked into fossil fuel-based technological systems through path-dependent processes that are driven by technological and institutional increasing returns to scale. The author also identifies sources of carbon lock-ins outlined in Table 6 below.

Table 6 – Sources of Carbon Lock-In (Unruh, 2002, p. 318)

Source	Example
Technological	Dominant design, standard technological architectures and components, compatibility
Organizational	Routines, training, departmentalization, customer-supplier relations
Industrial	Industry standards, technological inter-relatedness, co-specialized assets
Societal	System socialization, adaptation of preferences and expectations
Institutional	Government policy intervention, legal frameworks, departments/ministries

As a resource-based economy and one that has had some time to travel down the path surrounding these resources, Canada holds the potential to be locked in through multiple, if not all, of the sources that are outlined. The extent to which these lock-ins exist and how to settle them would extend far beyond the scope of the study. However, these do help us extrapolate that there are multiple sources of this lock-in and multiple facets in which these are present in Canada. This would likely lead to backlash for the federal government from, but not limited to, businesses, government agencies, and provinces with resource-based economies.

The final, and likely largest, source of backlash would likely come from that of the provinces. As mentioned in *Canada's Inheritance* section of this study, federal leadership had been lacking in the realm of policies tackling climate change. This has led to provincial leadership in the realm; until the arrival of The Framework, the provinces had been free to do as they had pleased in a presumed area of shared jurisdiction. As Weibust (2010) outlines, this is a result of the federal government's choice to not exercise powers the Supreme Court has declared it holds. This serves as a form of "quiet constitutionalism", where constitutional change occurs within a realm

without engaging in constitutional reform directly (McBride, 2003). Although the jurisdictional review provided above outlines that ultimately the federal government could act unilaterally, the assumption of leadership by the provinces will create a large amount of political and legal hurdles for it to overcome.

Chapter 5.

Conclusion

These sources of resistance to federal intervention limit the actions that the Government of Canada could take in order to steer the country towards its 2030 emissions reduction goal. The quantitative analysis conducted here reveals that there have been inconsistent results achieved by the jurisdictions that were studied. In terms of CTs, it finds that results over time were vary between jurisdictions and offer some reduction but does cannot guarantee the level of reduction. In regards to an ETS, reductions occurred in all jurisdictions studied; however, the extent to which the reductions took place were inconsistent between jurisdictions. It also found a statistically significant and prominent negative relationship between CTs and jurisdictions that employed an ETS. This dictates that these mechanisms can not only coexist but also offer further reductions when doing so. In analyzing where this occurred, the study finds an overall reduction of emissions, but again the extent of reductions were inconsistent between cases. The results of this study come with some limitations. First, all cases of carbon pricing were not analyzed as the sheer number of cases as well unique situations would lower the inferences that could be made. Second, time frames were placed around the cases in order to ensure that the effects of each mechanism and their overlap could be analyzed and the results from this would represent only the mechanism being studied specifically. The final limitation of this study was the ending the study period in 2014, as more contemporary data for all variables did not exist at the time of this study.

Considering the inconsistency displayed from the cases in this study, if Canada wants to avoid missing the targets it has set for itself, and avoid withdrawing yet again, it needs to ensure that results that are achieved across the provinces that move the country towards its overall emissions reduction goals. Not only this, but it should consider applying both CTs and an ETS across all jurisdictions in order to maximize the reductions that can be achieved. A combination of these two mechanisms would ensure that emissions in Canada are done so while ensuring cost as well as quality certainty. Here, the federal government has some tough decisions to make in what type of leadership it would like to display domestically. Provided the information that this study

offers, it will now outline three possible alternative paths that the Government of Canada can choose to shift to. These recommendations will be divided into high, moderate, and low cost scenarios and outline what these could potentially entail.

5.1. High Cost – Federal pricing system

The most costly way to shift the provinces and the nation to a more sustainable direction would be if the federal government chooses to implement its own carbon pricing mechanism. Not only will this be costly in terms of political and legal costs, this would also require a lot of further considerations that need to be made by the Government of Canada. As outlined earlier, there are already pricing mechanisms that exist within Canada, there are direct pricing systems (such as Alberta's Carbon levy or British Columbia's Carbon Tax), or a cap-and-trade system (such as the ones implemented in Ontario and Quebec) (Government of Canada, 2017b). With the potential for more pricing systems arriving as the January 2018 deadline for implementation comes closer. This would mean that the federal government would not only need to consider the political backlash that would come from taxpayers, who may or may not be receptive to the idea of being taxed further for emissions, but also from provinces who might object to the perceived overstepping of authority following a period of absence in the field.

5.2. Intermediate Cost – Expand the role of existing organizations

A less politically costly change in direction that can be taken by the federal government can come from expanding or amending the goals of existing organizations and/or institutions. One of the organizations that can be subject to this change can be the Canadian Council of Ministers of the Environment (CCME). The CCME represents all 14 environmental ministers in Canada, each with one representative from the federal, provincial and territorial governments (Weibust, 2009). According to the CCME (2014) the purpose of the body is to work as a forum in order to ensure collective action on issues that were of national and international concern, which includes a working committee with a focus on the issue of climate change. This centralizing organization that works through consensus (Weibust, 2009) has thus far been subject to the joint-

decision trap. This trap happens under two conditions: 1) the central government decisions are directly dependent upon the agreement of constituent governments, and 2) that the agreement of constituents governments must be unanimous or nearly unanimous (Scharpf, 1988, p. 254), encouraging a race to the bottom for policy innovation. There is also little evidence here that suggests that the CCME has produced policies that have resulted in improvements in the quality of environment (Weibust, 2010).

The largest change the federal government would have to make here is to implement some legal procedure through which provinces are obligated to implement policies that they themselves have negotiated, which has not necessarily happened consistently (Weibust, 2009). Enforcing this would not only work as a guiding force for the nation as a whole, but provide a proper forum through which policy convergence can occur. Howlett and Joshi-Koop's survey of over 190 policy professionals suggest that these professionals do not engage with non-government actors and other governments in terms of their work (2011, p. 91). The authors find that most of the analysts' networks consist of staff from other ministries within their own provincial government with rare instances of contact with foreign or the federal government (p. 89-90). Using this, the authors conclude that the potential for trans-national learning leading to policy convergence is limited in Canada (p. 91). Unfortunately, Howlett and Joshi-Koop's conclusion insists that a bottom up approach for policy development, eventually leading to policy convergence for the nation, is unlikely to happen under the current conditions. However a change in the mandate of specific institutions could result in addressing the current lack of communication between policy makers.

5.3. Low Cost – Bilateral Agreements with provinces

Perhaps the best method to lead all provinces and territories to a unified goal while ensuring compliance and signaling collaborative federalism would be to follow the path the federal government has taken in terms of immigration policy. Constitutionally, jurisdiction for immigration policy is shared between the federal government and the provinces but the field has been dominated by the federal government until relatively recently (Atkinson, et al., 2013). Federal predominance changed when it was challenged by Quebec in the 1960s with a push for decentralization which eventually led to the Canada-Quebec immigration agreement in 1991 (Banting, 2012, pp. 264-265). Between

1960s and 1991, there were four agreements signed between the province and the government of Canada in regards to immigration, including the 1991 agreement which is in effect today.[6] The provincial government of Quebec acquired a role in the selection, recruitment, reception, and settlement processes of new immigrants in these two decades, which at the time was more than anything the other Canadian provinces were previously able to accomplish or aspire to (Kostov, 2008, p. 91).

Other bilateral agreements with provinces in this realm began to emerge in the late 1990s, with the agreements being packaged as a comprehensive framework that outline how the governments are to collaborate on the agreements including an early iteration of the provincial Nominee Program (PNP) (Schertzer, 2015). This program represents powers that were transferred from the federal government to the provinces and a similar approach can serve well to clear up some complications in the environmental policy realms. Table 7 below offers a full list of agreements between Canada and the Provincial governments. As the table outlines there are currently agreements or pilot versions of these agreements in place in all provinces and territories with the exception of Nunavut. It is important to note that the PNP remains a federal program under the Immigration and Refugee Protection Act but in practice has been implemented through these agreements by the provinces (Schertzer, 2015). The program also allows the provinces to directly select a number of immigrants for permanent immigration to their territory, generally used to respond to the province's specific labour needs (Paquet, 2014).

[6] Agreements included: Lang-Cloutier Agreement (1971), Andras-Bienvenue Agreement (1975), Cullen-Couture Agreement (1978), and McDougall-Gagnon-Tremblay Agreement (1991) also known as the Canada-Quebec Accord (Kostov, 2008).

Table 7 – List of agreements between Canada and the Provinces/Territories (Government Of Canada, 2010b)

Province	Agreement
Quebec	1991 (February)
Manitoba	2003 (June)
Saskatchewan	2005 (May)
Alberta	2007 (March)
Yukon	2008 (May)
Northwest Territories	2013 (October)
British Columbia	2015 (April)
Ontario	2015 (May)
New Brunswick (Pilot)	2017 (March)
New Foundland and Labrador (Pilot)	2017 (March)
Nova Scotia (Pilot)	2017 (March)
Prince Edward Island (Pilot)	2017 (March)

Using bilateral agreements similar to the PNP offers a few advantages: it states in clear terms what the responsibilities are for each level of government, it creates a binding legal commitment by the provinces under the supervision of the federal government, and it also allows the provinces the ability to retain their role as a significant and influential shareholder in the realm. The Pan-Canadian Framework on Clean Growth and Climate Change does something similar to this, however it does not allow for separate considerations for provinces who do not share the same resources or natural endowments as others. As such, bilateral agreements could create a direction in which provinces work towards their own goals while input from the federal government ensures that these goals comply with the long term vision for the country as a whole.

This study has only scratched the surface while analyzing the tightrope that the provincial as well as federal governments need to walk when implementing and/or changing carbon pricing policies. It has provided results of previous implementations of the two suggested carbon pricing mechanisms in The Pan-Canadian Framework on Clean Growth and Climate Change. Although the results are far from what was required in order to meet the self-imposed goals of each jurisdiction, they did work to create an era of policy innovation that can provide lessons to Canada. These jurisdictions show that steps need to be taken outside of what the Framework currently states and a combination of both mechanisms should be implemented in order to achieve the best

results possible. Jurisdictional review within Canada shows that the federal government could be justified in acting unilaterally to create a national carbon pricing scheme that includes both mechanisms across the nation. This study finds that due to the inconsistent results that have been yielded from previous implementations of single mechanisms, the federal government of Canada needs to play a more prominent role in guiding the provinces towards a unified goal.

Although unilateral action by the federal government could be constitutionally justified, this action would go against the grain of the federation's current evolution. Here the federal government has three potential courses of action that break the current path dependencies and carbon lock-ins that exist in Canada. However, it does not presume that it can accurately predict the quantitative costs of shifting away from these paths. Instead it offers three courses (high, moderate, and low) that vary in their political and legal costs. It suggests that the federal government can take a hardline unilateral action by implementing its own carbon pricing system, which it could have jurisdictional authority to do so but at a high cost. The moderate cost option suggests an alteration to the roles of existing institutions while the low cost option suggests engaging in collaborative federalism with the provinces individually in order to protect the interests of all parties. Regardless of the direction the country as a whole chooses to go, it is certain that Canada is currently at a crossroads and has some very tough decisions to make to offer a more sustainable future.

This study also shows the need for further research into the relationships that exist within this field. As carbon pricing becomes a more prominent tool in fighting rising emissions, so does the relationship between the economies of the jurisdictions using them, their use of the revenues generated by the pricing, the energy mixes, capacity for renewable energy production and the price that is placed on carbon itself. Given the variations that exist in this study, a more detailed look at the relation of further variables such as the level of foreign trade, the direct relationships between reinvestment strategies, and the capacity of the renewable production in direct relation to the demand for energy in each jurisdiction could also provide some interesting insight. As the reach and dependency on carbon is extensive, the scale of its reach needs to be investigated further than what has been in this study. This study also outlines the need to further study the effects of the level of pricing. Again, this may vary from jurisdiction to jurisdiction but studies in order to ascertain the level at which pricing should be placed in

order to deter producers and consumers to accept the costs of the pricing and change their behaviour in order to become more environmentally friendly should move scholarship ahead.

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