EUROPEAN COMMUNITY
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POLICY MEMO

British Columbia's Carbon Tax Impact on Industrial Sector Emissions: Comparing Policy Effectiveness with the EU Emissions Trading System'

Simon Dessureault, PhD Student
Public Policy at Carleton University

August 2020

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ECSA-C Research Group - Environment, Climate Change and Energy
Led by Joan DeBardeleben, Jean Monnet Chair in the EU's Eastern Neighbourhood Relations and Co-Director of the Centre for European Studies at Carleton University

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The Policy Memo

Background/Research Question

To mitigate climate change effects, British Columbia (BC) implemented a carbon tax in July 2008. However, British Columbia's (BC) emissions increased by 5.6% between 2005 and 2018 largely due to a surge in emissions from the transportation and oil and gas extraction sectors (ECCC, 2020), while the Rest of Canada's (ROC) emissions decreased by 0.6% over this same period (ECCC, 2019). These outcomes may suggest that BC carbon tax was not effective in reducing emissions, however to fully assess whether this is true one also needs to look at the emissions trajectory in view of overall economic growth and sectoral patterns. Also, BC's increase in emissions is not in line with Canada's commitment to the Paris Agreement which is to reduce emissions by 30% below 2005 emissions levels by 2030.

This policy memo poses the following research question: Can a facility-level analysis of emissions provide evidence-based policy recommendations to increase BC carbon tax effectiveness? To answer this question, a comparative facility-level impact analysis is conducted to assess BC carbon tax impact on large industrial facilities' emissions, which allows for the development evidence-based policy recommendations. Key findings are compared with the results of the most rigorous studies that have assessed the impact on emissions of the EU Emissions Trading System (ETS).

Methodology/data

Environment and Climate Change Canada's (ECCC) emissions data from large emitting facilities are used to conduct this analysis. For the purpose of this analysis, large emitting facilities are defined as facilities emitting over 50,000 tonnes of CO2 equivalent (CO2e) per year in 2009, and that were in operation during the 2009-2017 period. Large emitting facilities are relevant to conduct such analysis as they account for over 40% of Canada's total emissions; the industrial sector is the largest source of emissions in the country, with these emissions being produced by only 1,622 facilities.

The methodology used is a comparative facility-level analysis assessing emissions produced by BC and the rest of Canada's (ROC) largest emitting industrial facilities. A statistical analysis is performed on facility-level data comparing emissions of BC with the ROC, which provides a better understanding of the sectors and how they fare under carbon pricing. As emissions data is collected similarly in EU countries and Canada, following the United Nations Framework Convention on Climate Change's (UNFCCC) (2020) reporting requirements, the results of this analysis are compared with the key findings of the main studies conducted on the impact of the EU ETS on firm-level emissions.

Key findings

The facility-level analysis of Canada's largest emitting firms reveals a very different story than the overall economy data, following the BC carbon tax implementation in 2008. Graph 1 depicts the emissions of Canada's largest emitting facilities (>50,000 tonnes of CO2e) using ECCC's data for the 2009-2017 period. ECCC's dataset counts 53 large emitting facilities in BC and 376 large emitting facilities in ROC, which have been in operation during the 2009-2017 period. This graph indicates that BC's largest emitting facilities decreased their emissions by 5.1%, whereas the emissions of the ROC's largest emitting facilities increased by 5.5% during that same period.

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British Columbia's Carbon Tax Impact on Industrial Sector Emissions: Comparing Policy Effectiveness with the EU Emissions Trading System'

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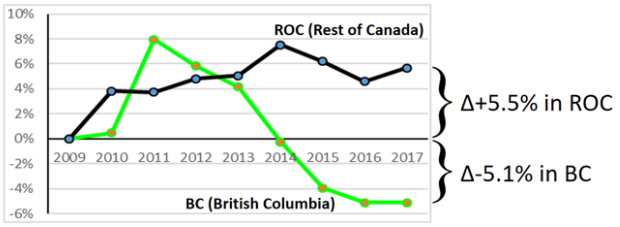
Graph 1. Emissions at the Facility-Level (Same Facilities - Year-Over-Year)



Source: ECCC (2019), author's calculations

The analysis below provides a nuanced picture of BC emissions per industrial sub-sectors, as a central element of this assessment is to avoid the trap in which carbon pricing would be heralded as a panacea. This industry-level analysis presented below allows for the identification of the potential "winners" or "losers" from the BC carbon tax and to quantify their performance under the carbon tax policy.

Table 1. Industry-Level Analysis of Emissions of BC's Large Emitting Facilities

		British Columbia (BC)			
NAICS	NAICS	2009	2017	Δ2017-2009	Δ2017-2009
Code	Description	tonnes	tonnes	tonnes	%
562210	Waste treatment and disposal	814,474	414,554	- 399,920	-49.1%
327420	Gypsum product manufacturing	48,504	25,243	- 23,261	-48.0%
211113	Conventional oil and gas extraction	3,476,664	1,934,444	- 1,542,220	-44.4%
221112	Fossil-fuel electric power generation	834,192	526,508	- 307,684	-36.9%
331313	Primary production of alumina and aluminum	1,299,929	862,357	- 437,571	-33.7%
327410	Lime manufacturing	64,383	53,595	- 10,788	-16.8%
322121	Paper (except newsprint) mills	37,779	38,891	1,111	2.9%
221330	Steam and air-conditioning supply	93,329	100,223	6,894	7.4%
331410	Non-ferrous metal (except aluminum) smelting/refining	371,468	413,369	41,901	11.3%
324110	Petroleum refineries	599,819	683,446	83,627	13.9%
327310	Cement manufacturing	1,185,251	1,363,527	178,276	15.0%
212233	Copper-zinc ore mining - Canadian industry	141,298	171,716	30,418	21.5%
221210	Natural gas distribution	107,439	142,534	35,095	32.7%
322112	Chemical pulp mills	742,192	1,049,894	307,701	41.5%
322111	Mechanical pulp mills	134,023	193,932	59,908	44.7%
212114	Bituminous coal mining	1,392,813	2,022,077	629,264	45.2%
486210	Pipeline transportation of natural gas	1,095,476	1,805,796	710,320	64.8%
	Total	**12,439,032**	**11,802,105**	**- 636,927**	**-5.1%**

Source: ECCC (2019), author's calculations.

Table 1 indicates that only six out of the 17 industrial sub-sectors (North American Industry Classification System (NAICS) 6-digit level) in BC have been able to reduce emissions for the 2009-2017 period. In these six industrial sub-sectors, the emissions reductions of the oil and gas extraction industry is reported at 1.54 million tonnes of CO2e, which is greater than the emissions reductions of the other five sub-sectors combined. These emissions reductions are for the same facilities, year over year, from 2009 to 2017. However, the total emissions from BC's oil and gas extraction industry surged from 3.48 to 5.37 million tonnes of CO2e, which represents an increase in emissions of 54% for this sector due to the opening of new oil and gas extraction facilities between 2010 and 2017. In other words, BC carbon tax did not prevent the opening of new oil and gas extraction facilities, which led emissions to increase by 54% for this sector.

BC and ROC's Carbon Productivity

One concrete measure to assess the economic impact of the BC carbon tax is to compare BC and the ROC's carbon productivity levels. Carbon productivity is defined as "the specific value of GDP to carbon dioxide emission over the same period, and it is equal to the reciprocal of carbon emission intensity of per unit of GDP" (Kaya and Yokobori, 1999 cited in Jiankun and Mingshan, 2011). According to Kaya and Yokobori's (1999) definition and for the purpose of this analysis, carbon productivity is measured as GDP per tonne of CO2 equivalent for BC and the ROC over the 2009-2017 period.

BC's carbon productivity was at a level of $3,447 of GDP per tonne of CO2 equivalent in 2009, which increased by 20% to reach $4,138 in 2017. In comparison, the ROC's carbon productivity was at $2,379 of GDP per tonne of CO2 equivalent in 2009, which increased by 13% to reach $2,683 in 2017. In 2009, BC's carbon productivity was 45% higher than the ROC's carbon productivity, whereas in 2017, BC's carbon productivity is 54% higher than ROC's carbon productivity. These results appear to indicate that BC carbon tax supported the province's economy to increase the value added or GDP per tonne of CO2 equivalent over the 2009-2017 period. However, GDP at firm-level would be needed to analyse if BC large emitting firms also have higher levels of carbon productivity than the carbon productivity of ROC's large emitting firms.

GDP at the firm-level is no longer published by Statistics Canada's Annual Survey of Manufactures (ASM), which was measured in the previous version of the ASM covering the 2002-2012 period (Statistics Canada, 2019). However, there are reasons to believe that the BC carbon tax did not negatively affect the economy and the industrial sector overall, based on ECCC's data on emissions and Statistics Canada's ASM. Emissions data from ECCC indicates that BC's large emitting firms reduced their emissions more rapidly their than the ROC's large emitting firms, while ASM's data indicates that BC's large emitters may have also increased their revenues and value added more rapidly than ROC's large emitters. BC's overall manufacturing sector also increased manufactured value added both as a percentage of total revenues and as a percentage of revenue from goods manufactured at a faster pace,

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compared to Canada's average. Statistics Canada (2019) defines "revenue from goods manufactured" as "the revenue from the sale of the physical goods manufactured" which "also includes revenue from manufacturing service fees and custom work, as well as from repair work. In these cases, only the labour is charged to the clients, as the materials and products are owned by them."

ASM's data is only available from 2012 to 2017, which closely corresponds to the 2011-2017 period that represents the period of fastest decline in emissions for BC's large emitting firms since the implementation of the carbon tax in 2008. These economic indicators point to the possibility that, while operating under a carbon tax policy, BC's larger emitting firms economically outperformed the ROC's large emitting firms, while reducing emissions more rapidly than the ROC's large emitters. While ECCC's data was used to test the statistical significance of the difference in emissions change over time, economic performance indicators of competitiveness remain to be similarly tested with an empirical analysis using firm-level data.

Results from Studies on the EU Emissions Trading System (ETS)

In Europe, several firm-level studies have been conducted to assess the impact of carbon pricing on firms' emissions. For instance, Wagner et al. (2013) find a statistically significant reduction in emissions close to 16% over the 2008-2012 period for the French manufacturing firms subject to the EU ETS. Petrick and Wagner (2014) firm-level analysis indicates that German manufacturers subject to the EU ETS have reduced their emissions by 26% between 2008 and 2010 relative to nonparticipating firms. Emissions reductions were mainly achieved by improving energy efficiency. Klemetsen et al. (2016) assess the impact of the EU ETS on Norwegian plants' emissions and economic performance and results indicate weak emissions reductions among Norwegian plants but the policy has no significant effects on emissions intensity. Jaraite and Di Maria (2016) find that the EU ETS did not reduce emissions in Lithuania, but improved emission intensity. Using facility-level data from firms operating in France, Netherlands, Norway and the United Kingdom, Dechezleprêtre et al. (2018) find that the EU ETS has induced emission reductions of 10% for the regulated facilities over the 2005-2012 period, but had no negative impact on the economic performance of regulated firms.

Deficiencies in BC's Carbon Tax Policy

This analysis points at two main deficiencies characterising BC carbon tax. First, BC carbon tax is not supporting the province in reducing its emissions at a faster pace than the ROC. From 2005 to 2018, BC has increased its total emissions by 5.6%, compared to ROC's average total reduction of 0.6% for the same period (ECCC, 2020). As BC's emissions are on the raise, it is likely that BC will become one of the provinces to prevent Canada from meeting its commitment to the Paris Agreement. Based on these results, other measures would be required for BC to meet Canada's 2030 target. Second, at the industry-level, BC carbon tax has not led to the reduction of emissions in 11 out of the 17 large industrial sectors in BC, covered by facility-level emissions data. In other words, the policy does not create enough incentives for the majority of large emitting firms in BC to curb emissions. More precisely, 32 facilities or 60% of the 53 BC's large emitting facilities were not able to reduce emissions over the 2009-2017 period. BC carbon tax appears to lack stringency to create effective incentives for large emitting facilities to reduce emissions across industrial sub-sectors. Hence, additional measures would be required for BC to create incentives to allow the majority of its industrial sectors to reduce their emissions compared to 2009 over the coming years.
These two deficiencies point to one central issue of the carbon tax, which is that the tax levels are not high enough to incent the level of emissions reductions needed to support BC in meeting its 2030 target. For instance, the Office of the Parliamentary Budget Officer's (2019) economic analysis reveals that for BC to meet its 2030 target, the carbon tax would need to rise gradually to $102 per tonne of CO2 equivalent by 2030. However, there are obvious issues around the political feasibility of such a carbon tax increase, at least for the time being.

Alternatively, BC could explore the opportunity to increase the proportion of emissions subject to the carbon tax, which is outside of the scope of this policy memo. However, based on BC's Budget and Fiscal Plan (2017), the carbon tax has generated a revenue of $1.19 billion in the 2015-2016 budget year, during which BC's emissions were at a total of 63.5 millions tonnes of CO2 equivalent. This represents an average revenue of $18.74 per tonne, even though BC carbon tax was at $30 per tonne in both 2015 and 2016. This is an issue of carbon tax collection consistency, which is discussed further below.

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Recommendations

Two recommendations are provided to increase BC carbon tax effectiveness. First, BC could review the design of the carbon tax revenues collection mechanism to reflect targeted emissions, as the 2015-2016 revenue from the carbon tax is nearly 11% below target. Based on BC's Budget and Fiscal Plan (2017), the carbon tax generated a revenue of $1.19 billion in the 2015-2016 budget year, during which BC's emissions were at a total of 63.5 million tonnes of CO2 equivalent. This represents an average revenue of $18.74 per tonne, even though BC carbon tax was at $30 per tonne in both 2015 and 2016. BC carbon tax effectiveness would only increase if the tax was collected as deemed at $30 per tonne rather than at an average of $18.74 per tonne. Although this recommendation is not directly derived from the facility-level data analysis, such measure would likely have the greatest impact on emissions reductions.

The Government of British Columbia (2019) mentions the "carbon tax applies to the purchase and use of fossil fuels and covers approximately 70% of provincial greenhouse gas emissions". Thus, if 70% of emissions are covered, the carbon tax should have generated revenues of $1.33 billion in 2015-2016 budget year. Hence, the carbon tax revenue of $1.19 billion in the 2015-2016 budget year is nearly 11% below target. To support further reductions, the government could ensure that the carbon tax is collected as deemed. This could potentially lead to further low-carbon technology adoption. To that effect, Calel and Dechezleprêtre (2016) find that the EU ETS increases low-carbon technology innovation among regulated companies by 30% in comparison to firms not submitted to the policy.

Second, BC could develop a cost-sharing program for large emitting firms to create incentives for the industry to increase low-carbon technology adoption. The industry:government cost sharing ratios could be determined based on further analysis and on emissions reductions costs per industry. The level of contribution could vary from one industry to another due to varying costs to lower emissions. A customised program based on technology adoption costs would provide support to industries that could otherwise find it too costly to reduce emissions, which is consistent with both the first recommendation and Calel and Dechezleprêtre's (2016) findings. In addition, such program could support industry's research and development initiatives that could lead to new and innovative technologies aimed at lowering emissions.

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Simon Dessureault is pursuing his PhD in Public Policy at Carleton University where he is conducting research on carbon pricing policy. More precisely, he is assessing the link between carbon pricing, emissions abatement, and competitiveness in the industrial sector. Simon is also a Senior Policy Analyst at Agriculture and Agri-Food Canada (AAFC), where he has been leading economic research, and policy analysis and development initiatives since 2016. Prior to joining AAFC, Simon was Senior Advisor, Policy and Economics at the Dairy Processors Association of Canada. From 2007 to 2016, he has held two managerial positions in the food processing industry related to marketing, innovation, product development, and export. From 2004 to 2007, Simon was Research Analyst for the George Morris Centre, an agri-food economic research institute based in Guelph. In 2018, Simon was appointed to the board of directors of the Canadian Agricultural Economics Society (CAES) serving on the Program Committee, where he contributes to organising successful conferences and brings his perspectives to the CAES Publications Committee. Simon received a Bachelor of Science in Agricultural Economics from Laval University and a Master of Science in Food, Agricultural and Resource Economics from the University of Guelph. His graduate research project was awarded Outstanding M.Sc. Thesis in Food Distribution & Marketing by the Food Distribution Research Society based in the United States.

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