Carbon Tax and Fuel Consumption

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Introduction

Canada's federal carbon pricing program was discontinued as of April 1, 2025, following sustained criticism that the policy contributed to rising living costs. This paper evaluates the effectiveness of carbon taxation in reducing carbon emissions by examining its impact on fuel consumption. Specifically, we assess whether Quebec's 2007 carbon tax led to a statistically significant reduction in per capita fuel consumption relative to Ontario, a neighboring province that did not implement a carbon pricing scheme until 2019.

Using a Difference-in-Differences (DiD) framework, we analyze monthly fuel consumption data from 2001 to 2012, ensuring sufficient pre- and post-treatment observations to isolate the policy's effects. The intuition behind this approach rests on the assumption of parallel trends and no anticipatory behavior prior to the tax implementation in October 2007. Under these conditions, any observed divergence in post-treatment trends between Quebec and Ontario can be plausibly attributed to the carbon tax rather than pre-existing differences.

We hypothesize that Quebec experienced a relative decline in per capita gasoline consumption following the introduction of the tax. However, given the modest magnitude of Quebec's initial carbon levy, the estimated effect may be economically small or statistically insignificant. This study contributes to the broader literature on carbon pricing by providing empirical evidence on the responsiveness of fuel demand to early subnational carbon tax policies in Canada.

Motivation

The motivation of this study is to use a natural quasi-experiment to understand the effectiveness of emission taxes, such as carbon tax on emissions, by estimating the effect of these taxes on fuel consumption. It is essential to understand how effective policies of this nature are so that we can plan accordingly for future emission policies, allowing us to reduce emissions more effectively. The Quebec carbon tax will enable us to study the effects of a carbon tax on fuel consumption in an experiment-like environment, as we have a counterfactual in the form of Ontario, which only implemented a carbon tax around 12 years after Quebec's initial tax.

Moreover, Quebec's 2007 carbon tax has been underexplored and overshadowed in this research field by British Columbia's rigorous carbon tax. This is understandable because Quebec's tax of around $3.5/tonne of CO_2 was too modest and targeted distributors instead of consumers directly. In comparison, British Columbia's initial carbon tax, implemented in 2008, equated to $10/tonne of CO_2 (Government of Canada, n.d.). Figure 1 displays a comparison between British Columbia and Quebec's nominal carbon taxes in cents per liter according to Erutku and Hildebrand (2018). The figures presented indicate that British Columbia charged a significantly higher sum per liter of gasoline than Quebec from 2007 to 2012. We can see that Quebec initially charged 0.94 cents per liter in 2007, and that figure only increased to 1.01 cents per liter over the following five years. On the other hand, British Columbia initially charged a carbon tax that equates to 2.34 cents per liter in 2008, and that figure approximately tripled to 6.67 cents per liter over the following four years. Therefore, despite Quebec's early adoption of the carbon tax, and while it represented a pioneering step, it was not as powerful a carbon pricing system as British Columbia's carbon tax, which is why there is a lack of comprehensive analyses analyzing its effect on gasoline consumption. Moreover, understanding more about the carbon tax and its effects as a pricing mechanism on different outcomes through past literature will aid in contextualizing the design and findings of this study.

Literature Review

In this section we will review key empirical studies on carbon taxation, providing a comprehensive assessment of their effects on environmental outcomes, technological innovation, and consumer behavior. The literature establishes a foundation for understanding the heterogeneous impacts of carbon pricing mechanisms, with a particular focus on British Columbia and Quebec.

The first subset of papers focuses on empirical reviews. Köppl and Schratzenstaller (2013) conduct a systematic review of carbon tax impacts, examining environmental outcomes, economic performance, and social dynamics. Their analysis of existing empirical literature suggests that carbon taxes modestly reduce fuel consumption when tax rates remain low and static. Notably, they also find a negative effect on green technology innovation, raising questions about the efficacy of carbon pricing as a driver of long-term technological change. Similarly, Lilliestam, Patt, and Bersalli (2021) evaluate high-price carbon pricing systems, including the EU ETS, British Columbia's carbon tax, and Nordic carbon taxes. Their findings align with Köppl and Schratzenstaller (2013), indicating that even stringent carbon pricing schemes have underperformed in stimulating innovation.

Another subset of the literature examines how carbon taxes influence consumer behavior. Lawley and Thivierge (2018) analyze the impact of British Columbia's carbon tax on household gasoline consumption, employing a log-linear model to account for heterogeneous effects across urban and rural areas. Their results indicate that a 5-cent carbon tax reduced gasoline consumption by an average of 8%, with stronger effects in urban regions and negligible impacts in rural areas. Ertuk and Hildebrand (2018) extend this analysis by comparing short- and long-term responses in British Columbia and Quebec. Using provincial monthly data (1991–2015), they find that British Columbia's carbon tax induced an immediate 2.5% reduction in per capita gasoline consumption per one-cent increase, whereas Quebec's tax had no significant effect until a revised pricing system was introduced in 2015. Antweiler and Gulati (2016) investigate a 15% decline in British Columbia's fuel demand (2007–2014), isolating the role of carbon taxation while accounting for vehicle purchase decisions. Their instrumental variable approach, incorporating province, month, and year fixed effects, reveals that tax-induced fuel price increases have a threefold stronger effect on consumption than market-driven price fluctuations—a result they attribute to consumers' inability to predict volatile fuel prices.

Rivers and Schaufele (2015) conduct a similar approach to our analysis, employing a difference-in-differences (DiD) framework to assess whether carbon taxes exert a stronger influence on gasoline demand than equivalent market price changes. Their findings indicate that a 5-cent carbon tax reduced short-run demand by 8.4%, whereas a 5-cent market price increase reduced demand by only 2.1%, suggesting that carbon taxes are 4.1 times more salient to consumers. This study aligns methodologically with our approach, utilizing monthly gasoline consumption data and price decomposition. However, our analysis simplifies their model by introducing a binary treatment variable and an interaction term while maintaining rigorous controls for concurrent economic shocks through month and year fixed effects.

After reviewing previous literature and gaining a more comprehensive understanding of the impacts and effects of carbon taxes on different sectors, it is important to note how our design will contribute to the current literature. This study offers a detailed and methodologically robust analysis of Quebec's 2007 carbon tax and its influence on fuel consumption per capita. By leveraging a DiD framework, we aim to provide a precise evaluation of the tax's causal effect, while controlling for unobserved confounders such as seasonality and larger macroeconomic trends through the inclusion of month and year fixed effects. Building on the existing literature, such as Erutku and Hildebrand (2018), which identified weak and insignificant effects of Quebec's carbon tax on gasoline consumption, our study offers an updated and more streamlined investigation of the influence of a modest carbon tax has. It also somewhat contributes to the debate on carbon pricing effectiveness, echoing Lilliestam et al. (2021) and Antwiler and Gulati (2016) in posing the question of whether low-rate taxes can drive meaningful decarbonization. Moreover, our study aligns with Rivers and Schaufele (2015) and Lawley and Thivierge (2018) to some extent, methodologically, by developing a solid difference-in-differences approach to assess carbon taxes in a Canadian context. However, by simplifying the model with a binary treatment variable and only focusing on Quebec and Ontario as its counterfactual, we provide a streamlined yet robust framework that could be adapted to other provinces. Beyond the literature, a study of this nature would propose some insights for policymakers by potentially highlighting the limitations of low-rate carbon taxes and how necessary it is for further measures to be taken to achieve broader decarbonization goals.

Data

The data for this study was gathered from Statistics Canada. We obtained a monthly fuel consumption data set ranging from January 2001 to December 2012, which will be helpful since the tax was introduced in October 2007, as well as population data for Quebec and Ontario. Formally, the consumption dataset obtains values of monthly net sales of gasoline expressed in liters. Obtaining the population data was crucial to use per capita fuel consumption as the outcome variable. Without accounting for population, which is highly correlated to total gasoline consumption, the results would likely be somewhat uninterpretable or misleading, as changes in total consumption could simply reflect population shifts rather than behavioral responses to the carbon tax. However, due to the unavailability of monthly population data from Statistics

Canada, quarterly population estimates were used instead. As a result, each month within a given quarter shares the same population figure. For example, January, February, and March of 2001 are all assigned the population estimate for Q1 2001, since the only estimate available is that of Q1, while April through June of 2001 correspond to the Q2 2001 figure, and so forth. This inevitably introduces a degree of measurement error since the estimates are not entirely accurate month by month; however, due to time and resource constraints, more precise monthly population estimates could not be interpolated from the available quarterly population data.

Moreover, the Government of Canada's official site has provided the timeline of exactly when Quebec imposed the carbon tax, which will be crucial for the development of the post-treatment dummy variable in our model. Additionally, to account for temporal variation in fuel consumption, we created dummy variables for each month and year in the dataset. The month fixed effects control for seasonality and recurring monthly patterns, such as higher fuel usage during the summer months. Year fixed effects capture broader annual shocks, such as macroeconomic changes, technological advancements, or federal policy shifts that may uniformly impact both provinces in any given year. All in all, these fixed effects essentially help control for unobserved time-specific heterogeneity and improve the robustness and accuracy of the estimated treatment effect.

Figure 2 presents some descriptive statistics for the outcome variable, monthly fuel consumption per capita, for Quebec and Ontario. Notably, Quebec exhibits a substantially lower mean and median consumption of 88.3 and 88.93 liters, respectively, compared to Ontario's 101.25 and 101.9 liters, respectively. Despite having quite similar standard deviations, indicating comparable levels of variability or dispersion, the range of consumption is slightly lower in Quebec compared to Ontario. Building upon these descriptive statistics, Figure 3 visually presents the distributions of monthly fuel consumption per capita by province. While both provinces exhibit roughly bell-shaped distributions, the histogram for Quebec is notably shifted to the left compared to Ontario. This supports the lower central tendency for Quebec discussed earlier from Figure 2, indicating that the most frequent levels of monthly fuel consumption, according to the histograms, are concentrated in a lower range for Quebec, around 85-90 liters, than for Ontario, around 100-105 liters. Additionally, the Quebec histogram appears to be slightly more compressed, potentially reflecting the somewhat lower range of consumption observed in Figure 2, with fewer observations of significantly high consumption compared to Ontario. Furthermore, there appear to be no outliers for either province. This visual comparison of the distributions provides a more intuitive understanding of the differences in fuel consumption patterns between the two provinces, highlighted by the summary statistics.

Methodology

$$\mathrm{Y}_{imy} = \beta_0 + \beta_1 \cdot \mathrm{Quebec}_i + \beta_2 \cdot \left(\mathrm{Quebec}_i \times \mathrm{Post}_{my}\right) + \sum_{m=2}^{12} \delta_m \cdot \mathrm{Month}_m + \sum_{y=2002}^{2012} \theta_y \cdot \mathrm{Year}_y + \varepsilon_{imy}$$

$\mathbf{Y_{imy}}$, the dependent variable, represents per capita fuel consumption for province *i*, in month *m*, and year *y*. $\boldsymbol{\beta_0}$, the intercept, represents the expected value of the dependent variable, Y_{imy}, when the independent variables are set to 0. In this case, it should represent the average per capita fuel consumption when the Quebec and Post dummies are equal to 0, i.e., the observation belongs to Ontario and is pre-treatment, which serves as the baseline level of fuel consumption before any treatment effect occurs. $\boldsymbol{\beta_1}$, the coefficient for Quebec_i, represents the difference in Y_{imy} between Quebec and Ontario before the carbon tax was implemented. In this case, it captures the baseline difference in fuel consumption per capita between Quebec and Ontario before any treatment effect occurs. $\mathbf{Quebec_i}$ is a dummy variable that equals 1 if the observation corresponds to Quebec, and 0 if it corresponds to Ontario.

$\mathbf{Post_{my}}$ is a dummy variable that equals 1 if the observation is from October 2007 or later, i.e., after the carbon tax was implemented, and 0 for all months prior. $\boldsymbol{\beta_2}$, the coefficient for the interaction term, is the DiD estimate that we are interested in, and it represents the Average Treatment Effect on Treated (ATET). In the context of our study, the ATET captures the average change in per capita fuel consumption for Quebec, the treated province, relative to Ontario, compared to what it would have been in the absence of treatment or had the carbon tax never been implemented. $\mathbf{Quebec_i * Post_{my}}$, the interaction term, represents the interaction between the Quebec and Post dummy variables. This term only affects our dependent variable when the observation is post-treatment and corresponds to Quebec. $\boldsymbol{\epsilon_{it}}$ represents the error term, which captures all other unobserved factors that affect fuel consumption but are not accounted for in the model.

$\sum \boldsymbol{\delta_m} \cdot \mathbf{Month_m}$ represents the month fixed effects in our model. To account for seasonality and time-specific unobserved heterogeneity, our model includes month fixed effects, implemented through the creation of dummy variables for each calendar month. Specifically, twelve indicator variables are generated, one for each month of the year, with the January dummy omitted to serve as the reference category. The inclusion of these month fixed effects is critical, as fuel consumption patterns exhibit strong seasonal trends due to multiple factors such as weather conditions, travel behavior, and heating requirements. For example, gasoline consumption is typically higher during summer months due to higher travel volumes and higher air conditioning usage compared to other seasons. By controlling for these recurring monthly patterns, month fixed effects help isolate the effect of the carbon tax policy from regular seasonal fluctuations, thereby improving the precision and validity of the estimated treatment effect.

$\sum \boldsymbol{\theta_y \cdot Year_y}$ corresponds to the year fixed effects in the model. These fixed effects are included to control for broader time-specific shocks that vary across years but are common to both provinces. Similarly to the month fixed effects, we implement this by generating twelve dummy variables, one for each year in the dataset from 2001-2012, with the first year, 2001, omitted to serve as the reference category for the other years in the model. The inclusion of these fixed effects is key for isolating the true effect of the carbon tax from other macroeconomic, technological, or policy-related developments that could in some way influence fuel consumption over time. For example, fluctuations in global prices or changes in federal environmental regulations can affect gasoline consumption independently of the carbon tax implemented by Quebec in 2007. Similarly, economic recessions or booms could also impact our outcome variable, had we not controlled for these broader time-specific shocks. By absorbing these annual shocks, the year fixed effects strengthen the internal validity of this design, allowing us to attribute the changes in fuel consumption before and after the policy implementation to the actual policy, rather than to other developing yearly factors.

Results

This section presents the empirical findings from our difference-in-differences (DiD) estimation of the impact of Quebec's carbon tax on monthly fuel consumption per capita. To examine the robustness of the estimated treatment effect, three model specifications are reported in Figure 4: a baseline model without any fixed effects, a specification with year fixed effects, and a fully specified model that includes both year and month fixed effects, which is the model proposed in the methodology section. Additionally, we will also assess the validity of the two key assumptions, parallel trends and no anticipation, for any DiD design to ensure the credibility of our design.

Beginning with the coefficient on the Quebec dummy in the first specification, the estimate of -12.048 suggests that, on average, per capita fuel consumption in Quebec was 12.048 liters lower than in Ontario during the pre-treatment period. This difference reflects the baseline gap between the two provinces before the implementation of the carbon tax and before accounting for any treatment effects. The coefficient on the interaction term, Quebec*Post, is estimated at -2.046. This represents the difference-in-differences estimate and captures the average treatment effect of the carbon tax on fuel consumption per capita in Quebec relative to Ontario. Specifically, it suggests that, for Quebec, the carbon tax led to a 2.046-liter decrease, on average, in monthly fuel consumption per capita relative to Ontario, compared to what it would have been if the tax had not been implemented. Notably, this is the DiD estimate without the inclusion of any fixed effects.

Moreover, in the second specification, when year fixed effects are added, the Quebec coefficient decreased to -13.448, which indicates that, once broader annual shocks are accounted for, a larger baseline gap between Quebec and Ontario is present in fuel consumption per capita in the pre-treatment period. Strikingly, the interaction term coefficient increased to 1.156, which suggests that, after controlling for unobserved year-specific heterogeneity that may affect both provinces, the estimated treatment effect for Quebec becomes positive. Formally, it implies that, for Quebec, the implementation of the carbon tax in October 2007 led to a 1.156-liter increase, on average, in fuel consumption per capita relative to Ontario, compared to what it would have been had the tax not been implemented.

Finally, in the third specification, when both month and year fixed effects are accounted for, the Quebec coefficient remains relatively stable at -13.428, which reinforces the consistent baseline difference in consumption per capita between Quebec and Ontario. The interaction term coefficient in this specification is the most relevant, since this model includes both month and year fixed effects, and is estimated at 1.109 while being statistically significant, but only at the 10% level. While the magnitude is similar to the second specification, the inclusion of month fixed effects to account for recurring seasonal patterns in consumption over time helps develop a more robust estimate by controlling for additional time-specific heterogeneity. Formally, this means that, for Quebec, the carbon tax led to a 1.109-liter increase, on average, in fuel consumption per capita relative to Ontario, compared to what it would have been had the tax not been implemented. However, the relatively weak level of significance limits the strength of any causal inferences we can draw and thus does not provide strong enough evidence to conclude that the carbon tax led to an increase in fuel consumption for Quebec relative to Ontario. Therefore, our initial intuition that the modest Quebec carbon tax would have a relatively insignificant effect on fuel consumption per capita was somewhat correct; however, we did not anticipate the direction of the treatment effect to be positive. This surprising result could reflect short-term behavioral adjustments that may diminish or normalize over time, suggesting that a longer time frame for this study may smooth out any of these temporary effects.

Moving on to the parallel trends assumption, Figure 5 presents a plot of the monthly average per capita fuel consumption over the proposed time frame by province. It displays the pre-treatment and post-treatment trends for both provinces, Quebec in light blue and Ontario in dark blue, with the red dashed line indicating Quebec’s carbon tax enforcement in October 2007. Visually, it is evident that before the policy was implemented, the two provinces appear to exhibit somewhat similar trends, although they do not seem perfectly parallel. Post-treatment, we can see that Quebec's fuel consumption declines in a relatively stable manner, whereas Ontario's fuel consumption appears to experience a sharper decline. This visual observation coincides with our positive DiD estimate mentioned earlier, which implies that Quebec's fuel consumption practically decreased less relative to Ontario, after the tax was implemented. It is important to note that this is merely a graph of the raw trend lines and is not adjusted for any unobserved time-specific heterogeneity; however, it is a reassuring sign to obtain a visual pattern that coincides with our key result.

Furthermore, to formally assess the validity of the parallel trends assumption, we conducted another regression using only pre-treatment data to examine whether any significant difference in pre-treatment trends between Quebec and Ontario exists. The main result of this pre-treatment trend analysis is presented in Figure 6. Before interpreting the result displayed, it is important to note that the model is restricted to pre-treatment data prior to October 2007, and that the Pre variable essentially captures the overall change in per capita fuel consumption over time before the carbon tax was introduced. The estimate of 0.69 on the interaction term Quebec*Pre essentially means that, during the pre-treatment period, the trend of per capita fuel consumption in Quebec was increasing at a rate that was 0.69 liters of gasoline higher than in Ontario. Along with the fact that the coefficient is also statistically significant at the 1% level, this specifically indicates that before the implementation of the carbon tax, the fuel consumption trends were not entirely parallel. For the parallel trends assumption to hold, a nonsignificant estimate that was closer to 0 would have indicated no difference in pre-treatment trends between Quebec and Ontario.

Finally, we conducted a regression to assess whether there existed a difference in trends in the years immediately preceding the carbon tax implementation in Quebec as a formal check of the no anticipation assumption. The regression estimates are illustrated in Figure 7, with the model also accounting for any unobserved time-specific heterogeneity by including month and year fixed effects. We interact the Quebec dummy with year fixed effects and restrict the sample to only pre-treatment years, more specifically, 2001 to September 2007. The variables of interest from this regression are Quebec*2006 and Quebec*2007, and, in this case, the 2006 interaction is statistically significant at the 5% level, while the 2007 interaction is significant at the 10% level. This suggests some pre-treatment divergence between Quebec and Ontario in terms of fuel consumption per capita in the 21 months immediately preceding the carbon tax application. While this finding suggests an anticipation effect may have occurred, it is important to note that talks about a carbon tax being administered in Quebec were only initiated a few months before the implementation, while a formal announcement was made in June 2007 (Government of Canada). Therefore, any observed immediate pre-treatment trends are unlikely to be driven by the announcement of the policy but are likely due to other factors influencing the divergence between provinces in these years.

Discussion

This study examines the impact of Quebec's carbon tax on per capita fuel consumption, yielding findings that partially align with—but also diverge from—the existing literature. The baseline model estimates a reduction of 2.05 liters in monthly fuel consumption, consistent with prior research documenting modest effects under weaker carbon pricing regimes (Köppl & Schratzenstaller, 2023; Erutku & Hildebrand, 2018). However, the preferred specification, incorporating month and year fixed effects, reveals a counterintuitive increase of 1.109 liters in consumption relative to Ontario, albeit with weak statistical significance. This result contrasts with the predominantly negative (though often insignificant) effects reported in the literature and may reflect short-term behavioral adjustments or the relatively low salience of Quebec's early carbon pricing scheme, as suggested by Erutku and Hildebrand (2018). Notably, their study similarly found no significant effect of Quebec's carbon tax on fuel consumption prior to 2015, when the province transitioned to a more stringent pricing system. Our generally insignificant estimates also align with Köppl and Schratzenstaller (2023) and Lilliestam et al. (2021), who argue that weak carbon taxes often produce limited behavioral responses. Nevertheless, the positive point estimates relative to Ontario, a province without a carbon tax during the study period, warrants further investigation, ideally over a longer timeframe.

Several limitations of this analysis should be acknowledged, both to contextualize the findings and to guide future research on carbon pricing and energy outcomes. First, the construction of the per capita fuel consumption variable relies on quarterly (rather than monthly) population estimates, potentially introducing measurement error. While interpolating monthly population data using birth and death records could mitigate this issue, Statistics Canada does not publish monthly provincial population figures, complicating such adjustments. Second, the absence of key control variables—such as income levels, unemployment rates, and gasoline price fluctuations—may lead to omitted variable bias, particularly if these factors differentially influence consumption patterns across provinces over time.

A further concern is the potential violation of the parallel trends assumption underlying our difference-in-differences (DiD) design. Pre-treatment divergences in fuel consumption trends between Quebec and Ontario suggest that unobserved confounders may partially drive the estimated treatment effect, threatening the internal validity of our results. Additionally, the two-province comparison, while methodologically clean, limits the external validity of our findings. Provinces with more salient carbon pricing systems—or differing economic and demographic characteristics—may exhibit different responses. Finally, extending the post-treatment period could better capture long-term behavioral adjustments. As Erutku and Hildebrand (2018) demonstrate, Quebec's more robust carbon pricing system post-2012 only began exhibiting significant effects on gasoline consumption by 2015. Our analysis does not account for this later policy shift; an extended timeframe could thus provide deeper insights into the sustained impacts of carbon taxation.

Conclusion

This study employs a difference-in-differences (DiD) framework to assess the causal effect of Quebec's carbon tax on monthly per capita fuel consumption, using Ontario as a counterfactual. While the baseline model suggests a modest reduction in fuel consumption in Quebec relative to Ontario, the full model—incorporating month and year fixed effects—produces a weakly significant positive estimate. These counterintuitive findings underscore the complexity of consumer behavioral responses to less salient carbon pricing mechanisms and highlight the need for further research into the underlying behavioral dynamics.

In terms of directions for future research, there are several avenues that emerge from this study. First, extending the analysis beyond 2012 to capture the effects of Quebec's strengthened carbon pricing system would provide insights into long-term behavioral adaptation and policy efficacy. Additionally, expanding the geographic scope, incorporating relevant control variables, and refining monthly population estimates would enhance the robustness of causal inferences.

The mixed findings of this study carry important policy implications. The limited observed impact of a relatively low-salience, distributor-targeted carbon tax suggests that more substantial pricing levels may be necessary to achieve meaningful emissions reductions. Furthermore, as Köppl and Schratzenstaller (2023) emphasize, transparent communication and the allocation of revenues toward visible environmental initiatives are critical to fostering public support. Complementary measures, such as investments in low-carbon infrastructure (e.g., public transit expansion), could amplify the behavioral and environmental benefits of carbon pricing. Ultimately, an integrated policy approach—combining more salient pricing mechanisms, supportive regulations, and targeted decarbonization investments—will likely be essential to drive sustained reductions in fuel consumption and meet long-term climate objectives.

This study contributes to the growing literature on carbon pricing effectiveness while highlighting the need for further investigation into the behavioral and structural factors shaping policy outcomes. Future research should continue to refine empirical strategies and explore the interplay between pricing design, public perception, and complementary mitigation measures.

Figures:

Table 1: Nominal Carbon Tax (in cents per litre)

Date	British Columbia	Quebec
1 October 2007	0	0.94
1 July 2008	2.34	0.94
1 October 2008	2.34	0.92
1 July 2009	3.33	0.92
1 October 2009	3.33	0.93
1 July 2010	4.45	0.93
1 October 2010	4.45	1.00
1 July 2011	5.56	1.00
1 October 2011	5.56	1.01
1 July 2012	6.67	1.01
January and February 2015	6.67	3.04
March, April, and May 2015	6.67	3.36
June, July, and August 2015	6.67	3.33
September, October, and November 2015	6.67	3.64
December 2015	6.67	3.77

Sources: For British Columbia, Rivers and Schaufele (2015); for Quebec, Régie de l'énergie and Ministry of Sustainable Development, Environment, and the Fight against Climate Change.

Figure 1: Nominal Carbon Tax in cents per liter for BC and QC

Province	Mean	SD	Min	Max	Median	N
Ontario	101.25	5.55	85.07	113.07	101.90	144
Quebec	88.30	5.52	71.28	99.77	88.93	144

Figure 2: Summary Statistics for Monthly Fuel Consumption Per Capita by Province

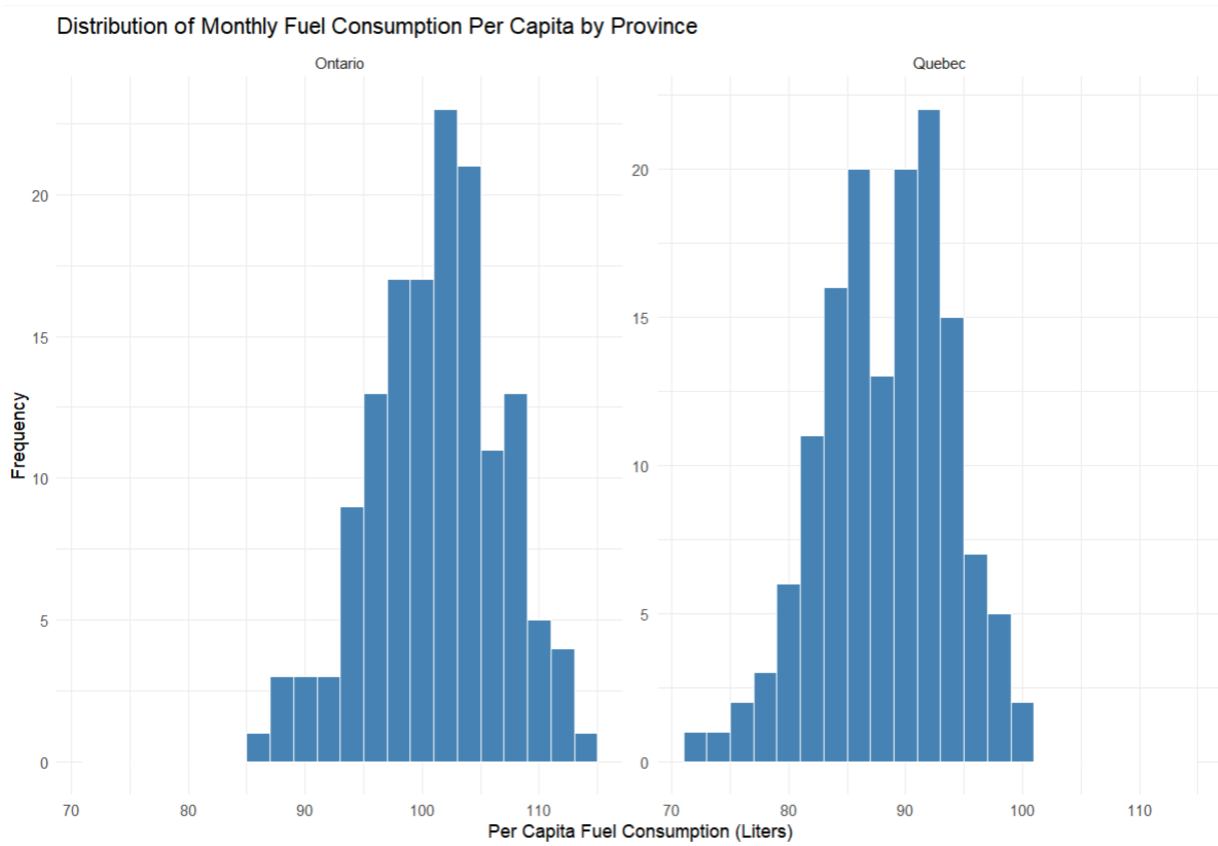

Figure 3: Distribution of Monthly Fuel Consumption Per Capita by Province

	No Fixed Effects	Year Fixed Effects	Year & Month Fixed Effects
Quebec	-12.048***	-13.448***	-13.428***
	(0.786)	(0.859)	(0.444)
Quebec × Post (DiD Estimate)	-2.046*	1.156	1.109+
	(0.901)	(1.175)	(0.663)
Num.Obs.	288	288	288
R2	0.586	0.628	0.891
R2 Adj.	0.583	0.611	0.882
RMSE	5.47	5.19	2.80

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Note: Dependent variable is monthly fuel consumption per capita. Month and Year fixed effects are included where indicated.

Regression Results: Effect of Carbon Tax on Fuel Consumption

Figure 4: DiD Main Regression Results

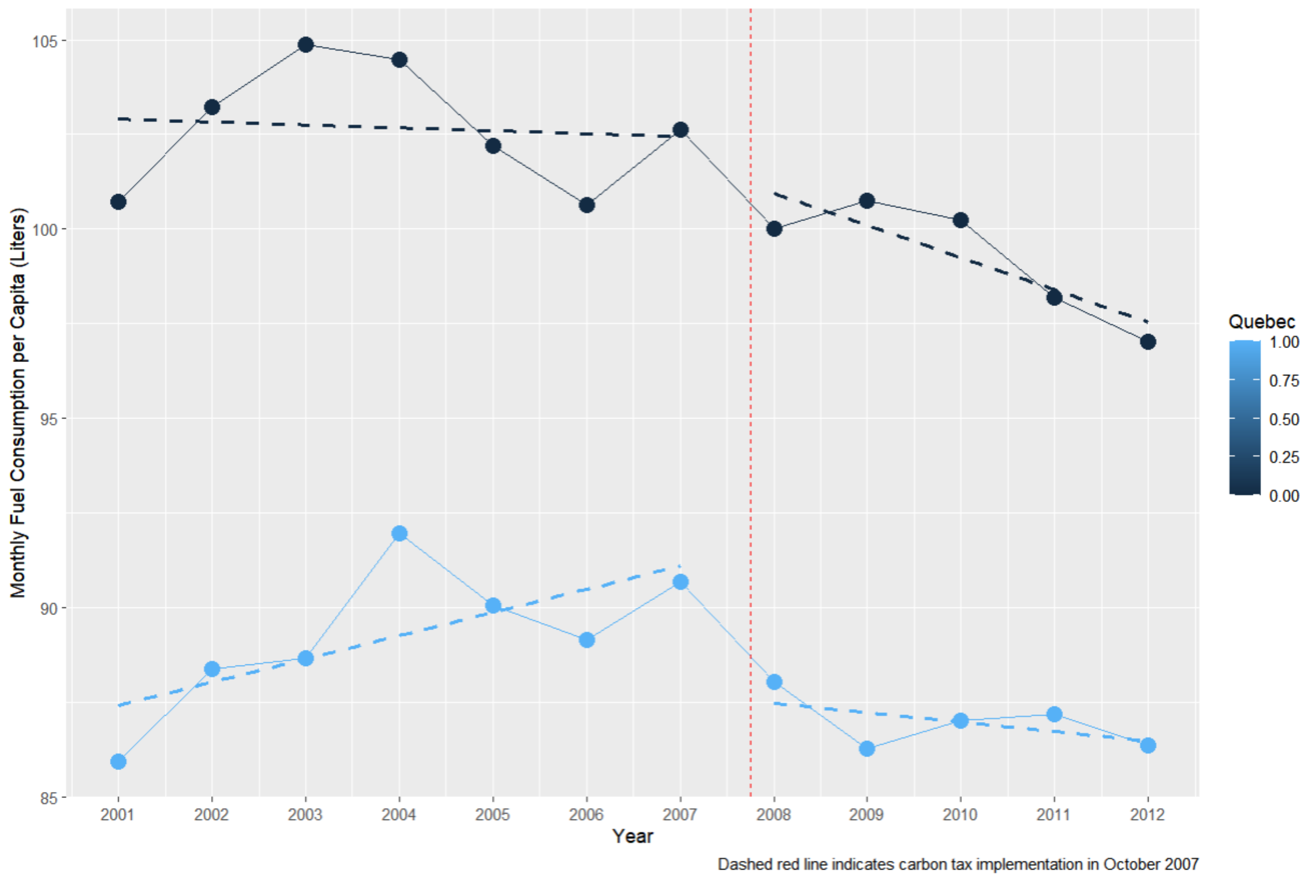

Figure 5: Fuel Consumption Per Capita Raw Trends Graph for Parallel Trends Assumption

Variable	Estimate	Std. Error	t-value	p-value
Quebec × Pre	0.690	0.204	3.38	0.001

Footnote: Regression includes month and year fixed effects; sample restricted to pre-October 2007 data.

Figure 6: Testing for Parallel Trends Using Quebec*Pre Interaction

Quebec × 2002	-0.064
	(1.828)
Quebec × 2003	-1.438
	(1.990)
Quebec × 2004	2.276
	(1.646)
Quebec × 2005	2.636
	(1.689)
Quebec × 2006	3.305*
	(1.599)
Quebec × 2007	2.840+
	(1.489)
Num.Obs.	168
R2	0.914

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Footnote: Regression includes month and year fixed effects; sample restricted to pre-October 2007 data.

Figure 7: Testing for No Anticipation Using Quebec*Year Interactions

References:

Antweiler, W., & Gulati, S. (2016). *Frugal cars or frugal drivers? how carbon and fuel taxes influence the choice and use of Cars.* SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2778868

Government of Canada. (n.d.). *Pricing pollution: How it will work.* Environment and Climate Change Canada. https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work.html

Köppl, A., & Schratzenstaller, M. (2023). Carbon taxation: A review of the empirical literature. *Journal of Economic Surveys*, 37, 1353–1388. https://doi.org/10.1111/joes.12531

Rivers, N., & Schaufele, B. (2015). Salience of carbon taxes in the gasoline market. *Journal of Environmental Economics and Management*, *74*, 23–36. https://doi.org/10.1016/j.jeem.2015.07.002

Lawley, C., & Thivierge, V. (2018). Refining the Evidence: British Columbia's Carbon Tax and Household Gasoline Consumption. *The Energy Journal*, *39*(2), 147-172. https://doi.org/10.5547/01956574.39.2.claw

Erutku, C., & Hildebrand, V. (2018). Carbon tax at the pump in British Columbia and Quebec. *Canadian Public Policy*, *44*(2), 126–133. https://doi.org/10.3138/cpp.2017-027

Lilliestam, J., Patt, A., & Bersalli, G. (2020). The effect of carbon pricing on technological change for full energy decarbonization: A review of empirical ex-post evidence. *Wiley Interdisciplinary Reviews Climate Change*, *12*(1). https://doi.org/10.1002/wcc.681

Dumortier, J., & Elobeid, A. (2021). Effects of a carbon tax in the United States on agricultural markets and carbon emissions from land-use change. *Land Use Policy*, *103*, 105320. https://doi.org/10.1016/j.landusepol.2021.105320