How Does the Carney Administration's Abolition of the Carbon Tax Affect Gasoline Prices?*

An ARIMAX-Based Evaluation Using Monthly Data from Canadian Provinces (Excluding Québec and Nunavut)

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This study evaluates how the abolition of the federal fuel carbon tax by the Carney Administration affects gasoline prices, fuel demand across Canadian provinces. Using monthly data from 2017 to 2025, we estimate a time series ARIMAX model for gasoline prices with crude oil prices, gasoline CPI, and carbon tax levels as external drivers. We then use a log consumption model with province fixed effects to measure the short run price elasticity of gasoline consumption. Counterfactual simulations suggest that maintaining the carbon tax would have raised gasoline prices by less than one cent per litre in most provinces and would have produced only very small changes in demand. As a result, we concluded the estimated impact on transportation emissions is limited. Overall, the findings indicate that short run gasoline market dynamics are shaped more by global crude oil conditions and household transportation needs than by the recent change in carbon tax policy. Canada policy should aim for a broader structural change to incentify more high tecn for more fuel-efficient or EV, to reduce the general demand to push down the gasolone price and greeenhouses emission.

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*Code and data are available at: https://github.com/Jie-jiao05/Carbon_Tax_Gasoline_Price/tree/main.

1 Introduction

Carbon pricing has long been regarded as a central component of Canada's climate policy framework and also a commitment from federal government's to environmental protection. Since 2019, under the Trudeau Administration, the federal government applied a fuel tax charge to provinces that did not develop their own compliant carbon pricing systems, and unified it nationally (Excluding Quebec). The objective of this measure was to encourage households and firms to reduce general consumption of fossil fuels, promote greener production. However, In early 2025, the Carney Administration announced the abolition of the federal carbon tax on gasoline and diesel. This policy was reveled as a significant shift in Canada's approach to climate governance. It also sparked nationwide debate concerning the affordability of carbon taxes, the extent of environmental responsibility, and the appropriate balance between climate policy and changes in gasoline prices.

The abolition of the fuel carbon tax directly affects retail gasoline prices, which are among the most visible and politically sensitive indicators of the cost of living in Canada. Canada is the fourth largest oil producer in the world, with a daily output of approximately 5.76 million barrels and about six percent of the global market share, ranking only behind Russia (U.S. Energy Information Administration 2024). Domestically, gasoline expenditures account for a substantial share of household budgets, especially in suburban and rural regions with limited public transit and in periods of extreme weather. Nationally, Fuel sales also represent an important source of government revenue. As a result, even small changes in gasoline prices can quickly alter consumption patterns and daily travel behaviour. Meanwhile, these behavioural adjustments might have direct consequences for greenhouse gas emissions for road transportation section, where the sector accounts for about 11.9 percent of global greenhouse gas emissions and nearly 74 percent of emissions from the transportation sector (U.S. Energy Information Administration 2024). Understanding how the removal of the carbon tax reshapes gasoline prices, and how these price movements influence gasoline consumption, and emissions, is therefore essential for assessing the broader economic and environmental implications of this policy change.

1.1 Research Questions

The purpose of this study is to evaluate how the Carney Administration's abolition of the federal fuel carbon tax influences gasoline prices and how these price changes impact Canada gasoline price and consumption adjustment. And how does the removal of Carbon tax causes transportation related emissions shift. To guide the empirical analysis, the following research questions are examined. And will be answered at Section 4.1.2.2 and Section 4.2.1.2

1. How did the abolition of the federal fuel carbon tax affect monthly retail gasoline prices in Canadian provinces that were subject to the federal fuel charge?

2. To what extent do changes in gasoline prices influence monthly fuel consumption across provinces once local economic conditions and climate factors are taken into account?

These research paper aim to answer this question for a comprehensive assessment of the economic and environmental consequences of the carbon tax abolition and provide a structured basis for evaluating both observed and counterfactual outcomes.

2 Data

2.1 Overview

This study uses monthly provincial data from 2017 to 2025. The main variables include the federal carbon tax (Canada Revenue Agency 2025), retail gasoline prices (Statistics Canada 2025b), the gasoline component of the Consumer Price Index(Statistics Canada 2025a), provincial gasoline sales quantity (Statistics Canada 2025c), monthly temperature and precipitation (*Canadian Climate Normals Climate Environment and Climate Change Canada* 2025), crude oil price (Trading Economics 2025), and the number of registered vehicles (Statistics Canada 2025d). The cleaning process will be explained in Section 2.2 and Section 2.3 respect to each specific variable section. These data are taken from Statistics Canada, Natural Resources Canada, Environment and Climate Change Canada, and Trading Economics. Together, we utilize these data to capture the key economic, climate, and transportation factors necessary to evaluate how the removal of the federal carbon tax influences gasoline prices, consumption conditions, and gasoline consumption pattern.

2.2 Exogenous Variable

2.2.1 Price Model Exogenous Variable — Gasoline Price

The retail fuel price measures the monthly average sales price of fuel in each province or territory, expressed in cents per litre. The data come from Statistics Canada's Monthly Average Retail Prices for Gasoline and Fuel Oil (Statistics Canada 2025b).

For data cleaning, this paper take the reported stations in the Statistics Canada as provincial representatives. For the case, when a province has multiple station-level observations in a given month, we take the simple average of all available stations to construct a representative provincial value. For provinces with only one reported station adopt that value directly.

Overall Figure 1 shows the monthly average gasoline price in Canada shows substantial variation between 2017 and 2025. Prices remained relatively stable between 2017 and early 2020, fluctuating around 110–130 cents per litre. A sharp decline occurred at the onset of the COVID-19 pandemic in 2020, followed by a rapid rebound beginning in late 2020. Prices then rose steeply throughout 2021 and peaked in mid-2022 at over 200 cents per litre. After this peak, gasoline prices gradually declined but continued to exhibit noticeable month-to-month volatility, settling between 140 and 170 cents per litre in 2023–2025.

On the provincial level Figure 2, all regions display broadly the same fluctuation pattern as the national average, with similar turning points across time. The highest recorded gasoline price was occurred in 2022-06, British Columbia reaches CAD225.3 cents per litre.

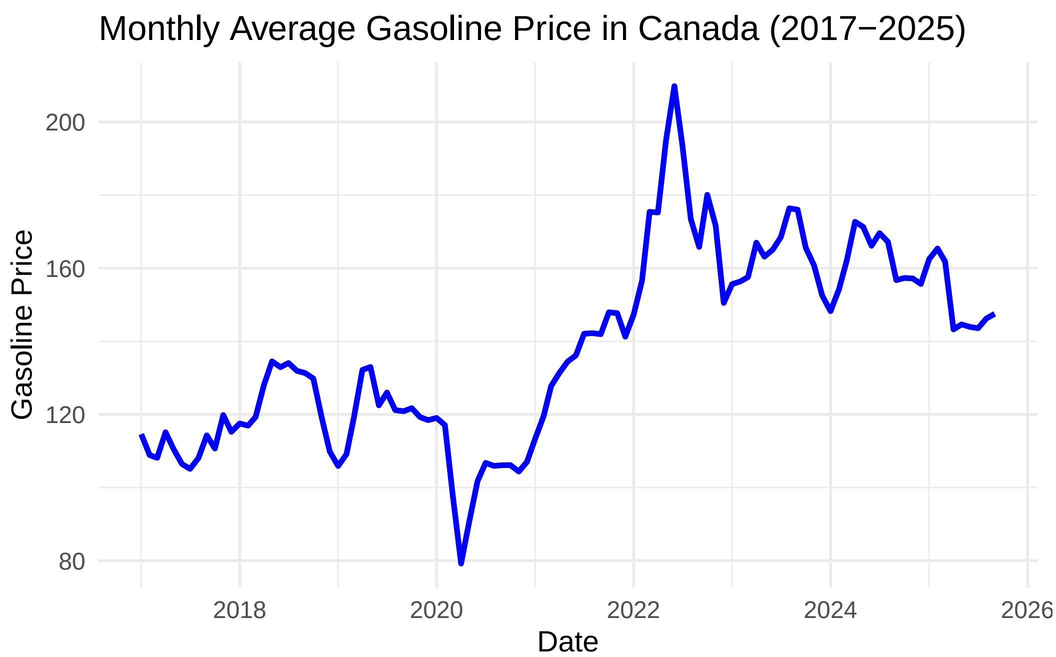


Figure 1: Gasoline Price in Canada (General Case)

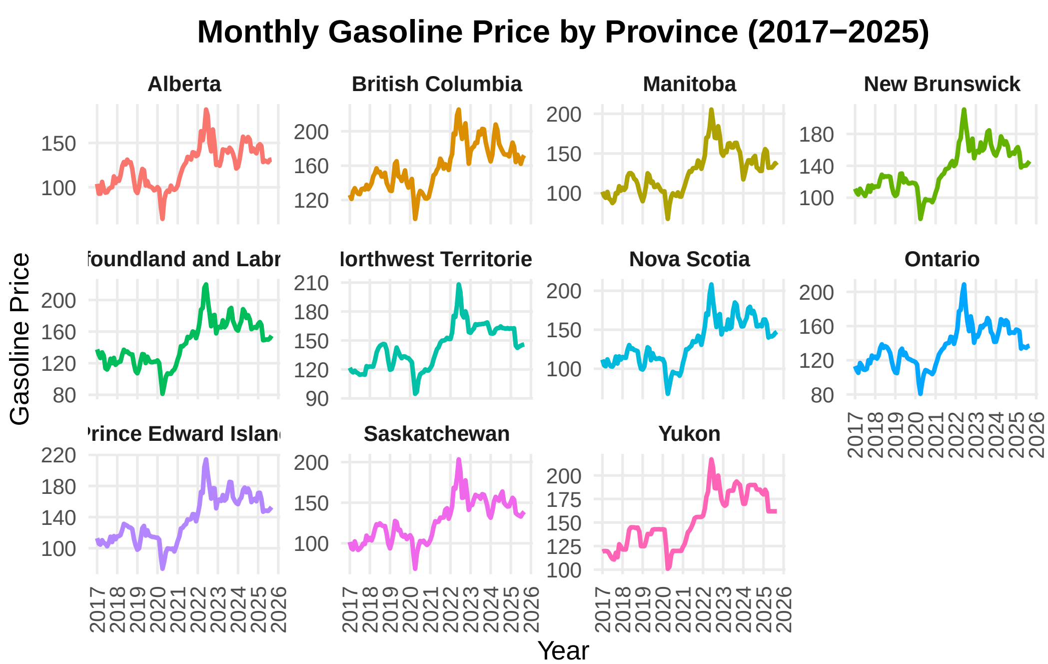


Figure 2: Gasoline Price in Canada by Province

2.2.2 Sales Model Exogenous Variable — Gasoline Sales Quantity

The gasoline sales quantity measures the total volume of fuel sold for road motor vehicles in each province, reported annually in units of one thousand litres. The data come from Statistics Canada's Sales of fuel used for road motor vehicles, annual (x 1,000) (Statistics Canada 2025c).

For data cleaning, since the original dataset provided was accounted in annual totals, to incorporate these data into a monthly time series model, each annual value was distributed across twelve months using a set of seasonally informed weights. For example, higher weights are assigned to months with traditionally higher gasoline consumption (Jun to Sept.). The resulting monthly series aligns with the frequency of other variables for a more robustic time series estimation.

Figure 3 is a annual gasoline sales by province, the trend over year is minor. But due to the overlarge data in Ontario, it makes plotting data from other provinces on the same linear axis would visually compress for provinces with lower sales. For example, data for the Yukon or Northwest Territories would appear almost horizontal at 0 line. To address this and preserve the relative differences between provinces, we used a logarithmic y-axis to create a clearer interpretation of trends across provinces with varying sales levels.

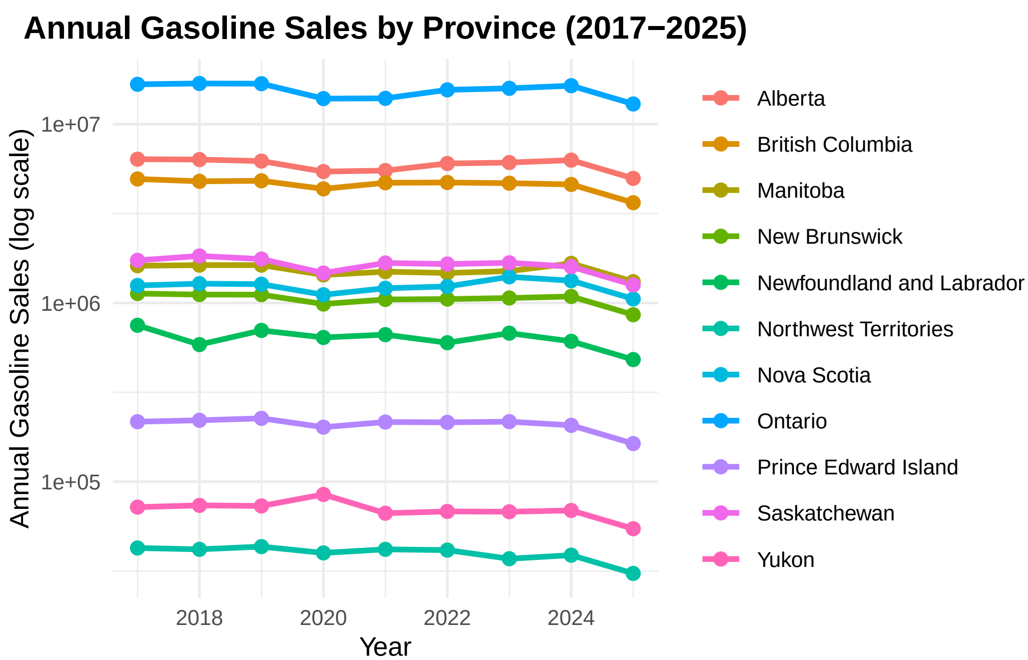


Figure 3: Gasoline Sales in Canada by Province

Table 1: Fuel charge rates by Province (Unit $ per Litre)

	Fiscal Year					
Province	2019/04-2020/04	2020/4-2021/4	2021/4-2022/4	2022/4-2023/4	2023/4-2024/4	2024/4-2025/4
NL	4.42	6.63	8.84	11.05	14.31	17.61
P.E.I	4.42	6.63	8.84	11.05	14.31	17.61
NS	4.42	6.63	8.84	11.05	14.31	17.61
NB	4.42	6.63	8.84	11.05	14.31	17.61
ON	4.42	6.63	8.84	11.05	14.31	17.61
MB	4.42	6.63	8.84	11.05	14.31	17.61
SK	4.42	6.63	8.84	11.05	14.31	17.61
AB	4.42	6.63	8.84	11.05	14.31	17.61
BC	8.89	8.89	8.89	9.96	11.05	17.61
YT	4.42	6.63	8.84	11.05	14.31	17.61
NT	4.70	7.00	9.00	11.70	14.31	17.61

2.3 Endogenous Variable

2.3.1 Carbon Tax

The provincial carbon tax is used as the key endogenous policy variable in the price model. It represents the per-litre fuel charge applied to gasoline under the federal carbon pricing system from 2019 until its removal by the Carney Administration in early 2025. For some certain provinces, such as British Columbia, do not follow the federal fuel charge, but operate their own provincial carbon-pricing systems. As a result, their gasoline tax rates differ from the federal schedule and we conduct a transformation to fit in. The values shown in Table 1 represent the applicable fuel charge rates for each province in every fiscal year (April to neaxt year March).

2.3.2 CPI:Gasoline

The gasoline Consumer Price Index comes from Statistics Canada's monthly CPI database (Statistics Canada 2025a). This dataset provides a very comprehensive measure of CPI changes across a wide range of category for each province. Since this study focuses specifically on behavioural responses to gasoline price changes, so only the gasoline-specific CPI series is retained.

Table 2 summarizes the average gasoline-specific CPI for each province from 2017 to 2025, capturing long-run differences in gasoline purchasing power across regions. Provinces such as British Columbia and Ontario exhibit the highest average CPI levels, indicating consistently stronger upward pressure on gasoline prices or higher underlying cost structures. In contrast, Yukon, Prince Edward Island, and the Northwest Territories show the lowest averages, suggesting comparatively slower growth in gasoline price levels over the period.

Table 2: CPI of Gasoline in Canada by Province

Province	Avg Gasoline CPI
Alberta	190.63
British Columbia	219.19
Manitoba	193.79
New Brunswick	182.53
Newfoundland and Labrador	188.88
Northwest Territories	180.23
Nova Scotia	195.38
Ontario	203.82
Prince Edward Island	179.22
Saskatchewan	181.45
Yukon	164.32

Table 3: Min and Max Registered Vehicle in Canada

Vehicle Registration Summary (Dec 2024)			
Min_Registered	Min_Province	Max_Registered	Max_Province
24733	Northwest Territories	8522581	Ontario

2.3.3 Quantity of Vehicle Registered

The quantity of vehicle registered refers to the total road motor vehicles(include all weight range) officially registered in a province registration system within a given year and it is accumulative (Statistics Canada 2025d). The provinces with the minimum and maximum registered vehicles as of December 2024 are reported in Table 3. By discover the change rate in registered vehicle, we can observe the quatity of car related to gasoline consumption.

2.3.4 Crude Oil Price

Our crude oil price are sourced from organization Trading Economic (Trading Economics 2025). Since crude oil is the only raw material for gasoline, it will significantly affects the price of the finished gasoline in the market. Figure 4 shows changes in crude oil and gasoline price under same time frame. As expected, Gasoline price are majorly caused by the shift in crude oil price in global. We estimated that the revenue earned by gasoline production firm is approximately \$60/liter (excluding cost like, labour, transportion, and etc.)

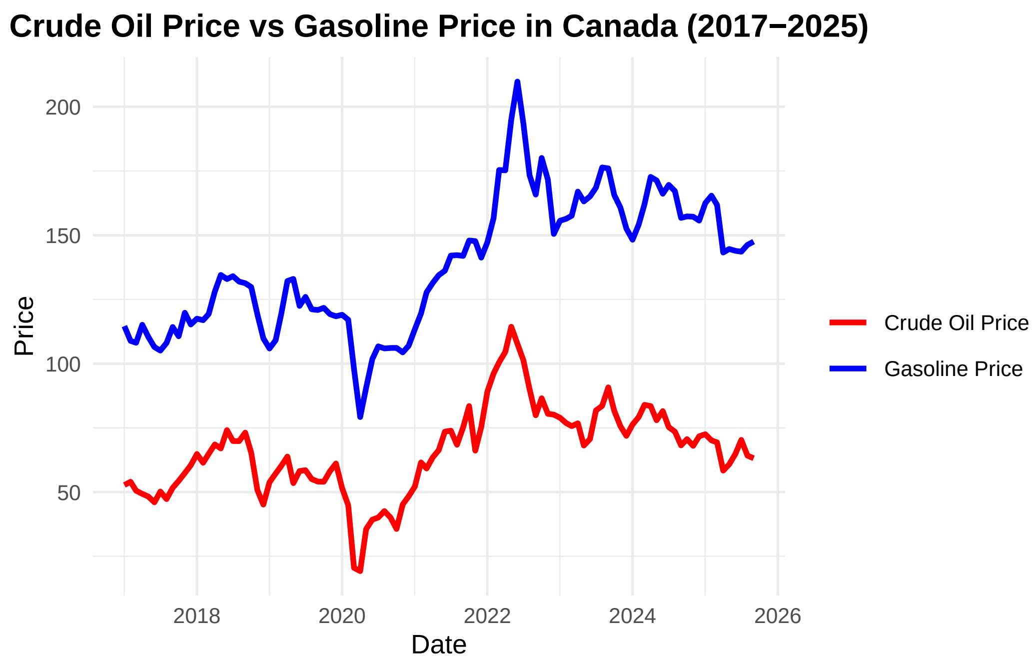


Figure 4: Change in Crude Oil Price with Gasoline

2.3.5 Climate and Precipitation

During extreme heat, cold, or rainy weather, people tend to use public transportation or private vehicles, which result in increasing gasoline consumption. Therefore, we incorporate these two variables into our model as exogenous variables. Our temperature and precipitation data are sourced from the Canada Environment and Climate Change website (*Canadian Climate Normals Climate Environment and Climate Change Canada* 2025).Due to limited data availability and to minimize the confounding effects of weather-driven behavioural changes(for instance, extreme weather may reduce overall mobility, but for some people might keep going out but choose transporatio method), we incorporate only a single representative year of climate observations, using each province's 2024 average temperature and total precipitation as fixed exogenous inputs in the model. Figure 5 illustrate difference province with their weather climate condition

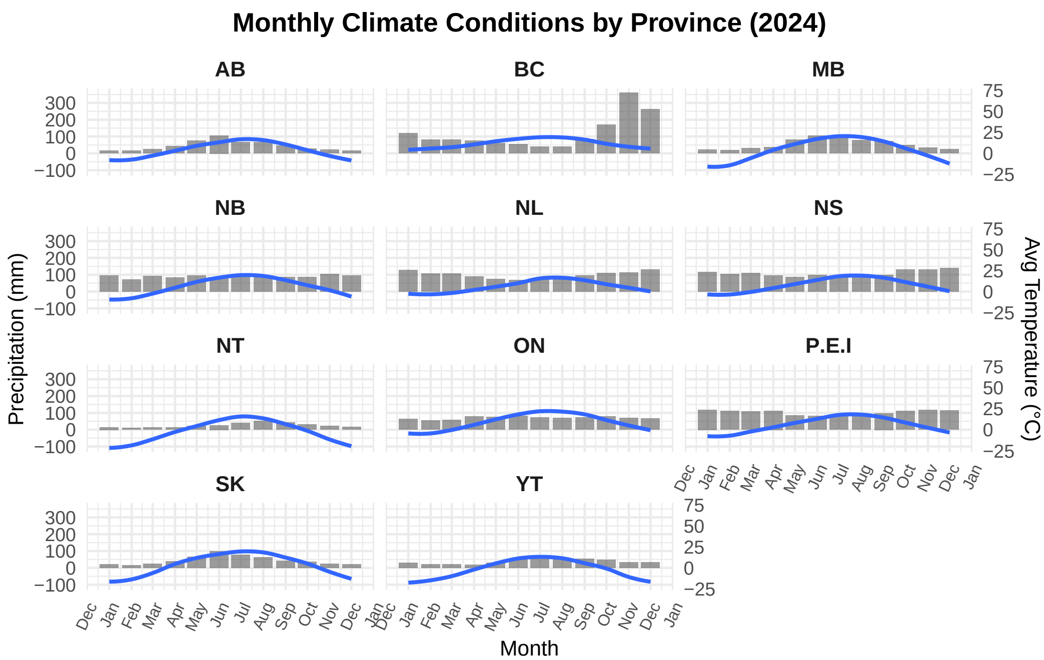


Figure 5: Temperacture and Precipitation Change by Provibce

3 Model

3.1 Price Model — ARIMAX

Our retail gasoline price series is recorded monthly, and displays clear time dependent patterns in Figure 1. These features imply that a simple regression model would produce biased or inefficient estimates, since the explanatory variables would be confounded with the inherent serial dependence in the price series. For this reason, the ARIMAX model is adopted. For ARIMAX this model preserves the ARIMA structure to capture the dynamic evolution of gasoline prices through explicit modelling of autoregressive and moving average components, which ensures that the estimated effects of external factors are not distorted by time series dependence. At the same time, the model enable to incorporates relevant exogenous variables such as crude oil prices, the federal carbon tax, and the gasoline component of the Consumer Price Index, allowing the model to separate tax policy driven price movements from broader market fluctuations. In this way, ARIMAX combines the interpretability of a traditional regression with the capacity to represent time series dynamics, making it well suited for analysing gasoline price formation in the presence of policy shocks. The interpretation relative to each coefficient will be illustrated in Section 4.1.

3.1.1 Price Model Assumption

1. Gasoline prices follow a time dependent structure where past price movements influence current prices.
2. External factors such as carbon tax, crude oil costs, and CPI gasoline are independent and measurable effects on monthly gasoline prices.
3. No strong or systematic seasonal pattern in gasoline prices, consistent with our exploratory analysis.
4. Relationship between gasoline prices and the included covariates is stable across provinces after controlling for province fixed effects.
5. Error term is stationary and serially correlated only through the ARIMA component.

3.1.2 Price Model Specification

The model takes the following form:

$$\log(\text{GasolinePrice}_{t,p}) = \beta_{0,p} + \beta_{1,p}\,\text{Tax}_{t,p} + \beta_{2,p}\,\text{CrudeOilPrice}_{t} + \beta_{3,p}\,\text{CPI\_Gasoline}_{t,p} + \varepsilon_{t,p}, \tag{1}$$

$$\varepsilon_{t,p} \sim \text{ARIMA}(p_p, d_p, q_p) \times (P_p, D_p, Q_p)_{12}, \tag{2}$$

$$u_{t,p} \sim \text{Normal}(0, \sigma_p^2). \tag{3}$$

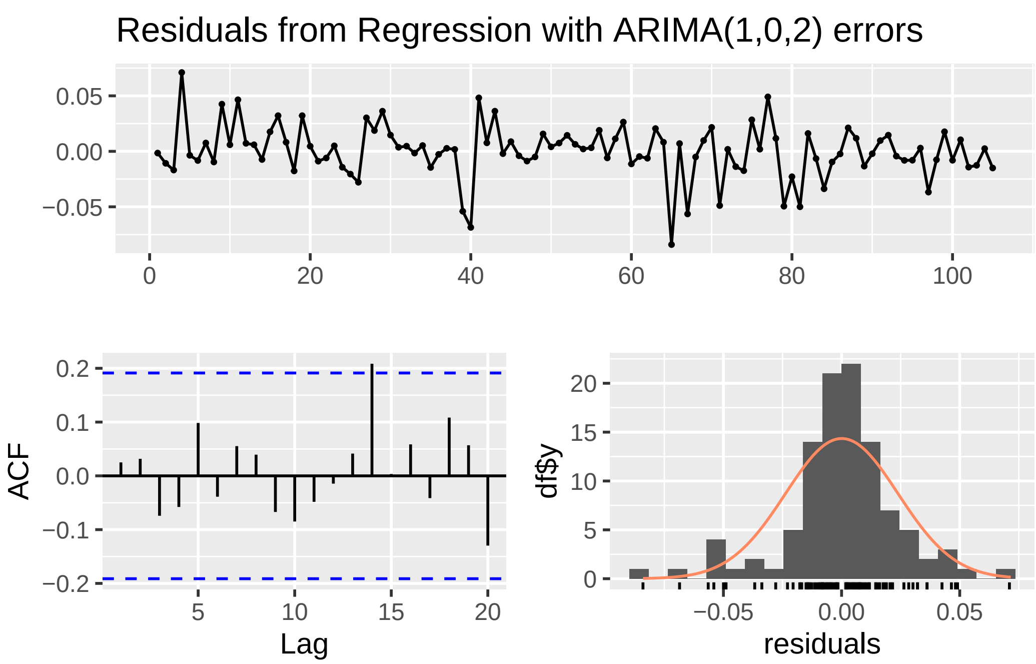
- p: province / territory index.
- t: monthly time index from January 2017 to September 2025.
- $\text{GasolinePrice}_{t,p}$: average retail gasoline price (cents per litre) in month t and province p; in the model we use its logarithm $\log(\text{GasolinePrice}_{t,p})$ to stabilise variance and interpret coefficients approximately as percentage effects.
- $\text{Tax}_{t,p}$: federal carbon fuel charge in cents per litre for month t and province p.
- CrudeOilPrice_{t}: benchmark crude oil price in month t , common across provinces.
- $\text{CPI\_Gasoline}_{t,p}$: gasoline component of the Consumer Price Index in month t and province p, capturing broader price-level movements.
- $\beta_{0,p}, \dots, \beta_{3,p}$: province-specific regression coefficients measuring how log gasoline prices respond to carbon tax, crude oil prices and gasoline CPI in province p.

- $\varepsilon_{t,p}$: regression residual for province p after removing the effect of the exogenous variables; it follows a province-specific seasonal ARIMA process ARIMA$(p_p, d_p, q_p) \times (P_p, D_p, Q_p)_{12}$ with 12-month seasonality, where the orders $(p_p, d_p, q_p, P_p, D_p, Q_p)$ are selected by `auto.arima` separately for each province.
- $u_{t,p}$: zero-mean Gaussian white-noise shocks driving the ARIMA error process in province p, with variance σ_p^2.

```
Series: y
Regression with ARIMA(1,0,2) errors

Coefficients:
         ar1      ma1      ma2  intercept  Tax_cents_per_litre  Crude_Oil_Price
      0.9283  -0.0801  -0.3342     4.0482               0.0018           0.0016
s.e.  0.0670   0.1306   0.1324     0.0482               0.0013           0.0005
      CPI_Gasoline
            0.0036
s.e.        0.0002

sigma^2 = 0.0006028:  log likelihood = 243.2
AIC=-470.39   AICc=-468.89   BIC=-449.16
```



```
    Ljung-Box test

data:  Residuals from Regression with ARIMA(1,0,2) errors
Q* = 4.3241, df = 7, p-value = 0.7418

Model df: 3.   Total lags used: 10
```

3.2 Consumption Model — Linear Regression

For Sales Quantity model we deploy a Linear regression model. The distribution of monthly sales appears approximately normal and shows limited seasonal variation in Figure 3 indicate that gasoline consumption does not exhibit strong cyclical patterns, which suggests that more complex time-series structures. In addition, the relationship between sales quantity and its key determinants—gasoline price, average temperature, precipitation, and vehicle registrations—follows a stable and interpretable form that is well captured by a linear model.

3.2.1 Consumption Model Assumption

1. Linearity: The expected value of monthly gasoline sales is assumed to be a linear function of gasoline price, temperature, precipitation, and the number of registered vehicles.
2. Independence: Monthly observations are assumed to be independent after controlling for the included predictors.
3. Homoscedasticity: The variance of the regression residuals is assumed to remain constant across all levels of the predictors.
4. Normality of Residuals: The residuals from the regression model are assumed to follow an approximately normal distribution.

3.2.2 Consumption Model Specification

$$\log(\text{Sales}_{t,p}) = \alpha_p + \beta_1 \log(\text{GasolinePrice}_{t,p}) + \beta_2\, \text{AvgTemp}_{t,p} + \beta_3 \log(\text{VehiclesReg}_{t,p}) + u_{t,p},$$

- $\text{Sales}_{t,p}$: monthly gasoline sales quantity in province p at time t.
- $\text{GasolinePrice}_{t,p}$: monthly average retail gasoline price.
- $\text{AvgTemp}_{t,p}$: average monthly temperature, capturing weather-related variation in driving activity.
- VehiclesReg_p: total registered vehicles in province p, treated as a time-invariant indicator of underlying transportation demand.

- α_p: province fixed effect capturing persistent differences in gasoline demand across provinces.
- $u_{t,p}$: regression error term.
- **Reference group**: Alberta.

```
Call:
lm(formula = ln_sales ~ ln_price + AvgTemp_C + ln_veh_reg + factor(Province),
    data = demand_data)

Residuals:
      Min        1Q    Median        3Q       Max
-0.268050 -0.052138  0.004154  0.055865  0.266382

Coefficients:
                                           Estimate Std. Error t value
(Intercept)                              18.5574978  1.7166388  10.810
ln_price                                  0.0319564  0.0147601   2.165
AvgTemp_C                                 0.0148163  0.0002417  61.309
ln_veh_reg                               -0.3773995  0.1172675  -3.218
factor(Province)British Columbia         -0.3902758  0.0128449 -30.384
factor(Province)Manitoba                 -1.8576344  0.1573225 -11.808
factor(Province)New Brunswick            -2.4071892  0.2021009 -11.911
factor(Province)Newfoundland and Labrador -3.0789017  0.2532783 -12.156
factor(Province)Northwest Territories    -6.7446667  0.5709389 -11.813
factor(Province)Nova Scotia              -2.2287520  0.1890615 -11.789
factor(Province)Ontario                   1.2525391  0.1152960  10.864
factor(Province)Prince Edward Island     -4.6486193  0.3985786 -11.663
factor(Province)Saskatchewan             -1.7987781  0.1615679 -11.133
factor(Province)Yukon                    -6.0479423  0.5264435 -11.488
                                          Pr(>|t|)
(Intercept)                               < 2e-16 ***
ln_price                                  0.03059 *
AvgTemp_C                                 < 2e-16 ***
ln_veh_reg                                0.00133 **
factor(Province)British Columbia          < 2e-16 ***
factor(Province)Manitoba                  < 2e-16 ***
factor(Province)New Brunswick             < 2e-16 ***
factor(Province)Newfoundland and Labrador  < 2e-16 ***
factor(Province)Northwest Territories     < 2e-16 ***
factor(Province)Nova Scotia               < 2e-16 ***
```

```
factor(Province)Ontario                      < 2e-16 ***
factor(Province)Prince Edward Island         < 2e-16 ***
factor(Province)Saskatchewan                 < 2e-16 ***
factor(Province)Yukon                        < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.08176 on 1141 degrees of freedom
Multiple R-squared:  0.9979,    Adjusted R-squared:  0.9978
F-statistic: 4.08e+04 on 13 and 1141 DF,  p-value: < 2.2e-16
```

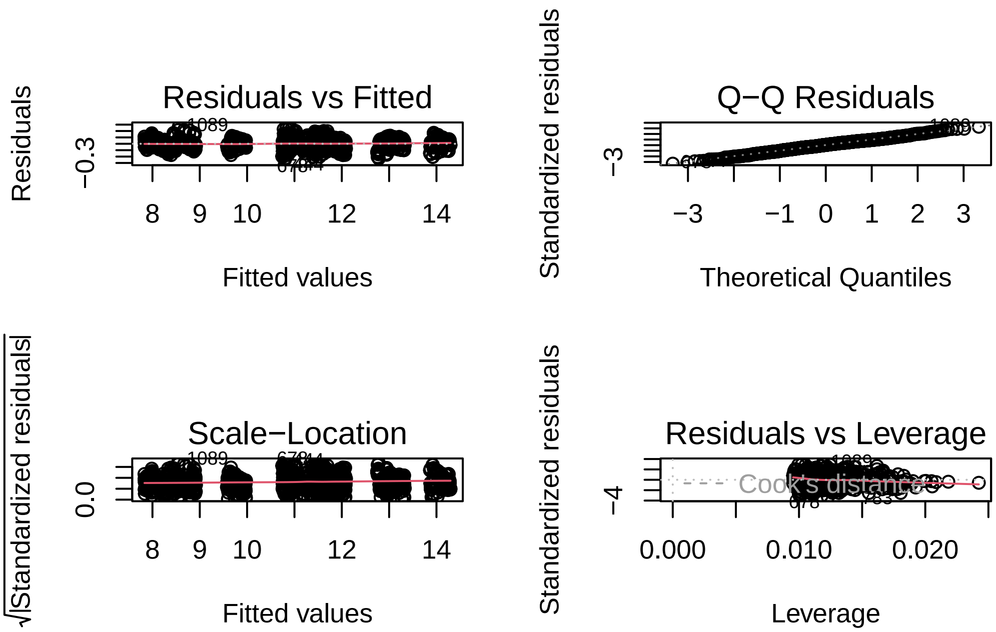


Figure 6: Assumption Check for Linear Regression

Figure 6 presents the diagnostic checks for the Price Model The Residuals vs Fitted plot shows no clear curvature, indicating that the linear functional form is appropriate for the model. The Q–Q Residual plot aligns closely with the 45-degree reference line, suggesting that the error terms are approximately normally distributed with only minor tail deviation. Meanwhile, the Scale–Location plot reveals a generally horizontal trend but with slight differences in residual spread across fitted values, but consider this Price model is a general model rather than for a specific province, so there exist a very mild heteroscedasticity issue. Finally, the Residuals vs Leverage plot shows most points well below the Cook's distance threshold, implying the absence of influential observations that could bias coefficient estimates. Overall, the regression model satisfies the main linearity and normality assumptions, with only a small concern regarding variance consistency.

4 Result

4.1 Model Estimation Result and Interpretation

4.1.1 Price Model Interpretation

Since our model are build for each province separately, for interpretation we will select Ontario to be a example for coefficient interpretation. Firstly, our model result in P-value of 0.7418 which indicates the residuals behave like white noise, giving high confidence that the ARIMAX model sufficiently accounts for time dependence. Our ARIMAX is be determined as ARIMAX(1,0,2). The estimated AR(1) coefficient (0.9283) is strongly positive and highly significant, indicating that gasoline prices are highly persistent over time—current prices are strongly influenced by prices in the previous month, which is consistent with the well-known sticky adjustment of retail fuel markets. The two MA terms, -0.0801 and -0.3342, jointly capture short-run shock adjustments, suggesting that unexpected price innovations are gradually corrected over subsequent months rather than dissipating immediately.

Turning to the exogenous carbon tax policy and market variables, the estimated coefficient on the carbon tax ($\beta = 0.0018$) is positive, implying that increases in the per-litre federal fuel charge are transmitted into higher retail gasoline prices, although the magnitude suggests the impact is partial pass-through. Holding all other factors constant, a one-cent increase in the federal carbon tax is associated with approximately a 0.18% increase in retail gasoline prices. The crude oil price and CPI-Gasolone coefficient ($\beta = 0.0016$ and $\beta = 0.0036$) are also positive, reflecting that higher crude and CPI will tend to raise upstream wholesale costs and eventually increase retail pump prices.

4.1.2 Price Model Counterfactual Analysis

4.1.2.1 Set Up

To quantify how the removal of the federal carbon tax affected provincial gasoline prices, we construct a counterfactual scenario using our province-specific ARIMAX price model. The ARIMAX framework models gasoline prices as a function of carbon tax, crude oil prices, gasoline CPI, and autoregressive seasonal dynamics. For the counterfactual, we keep all market variables (crude oil price and CPI) at their observed 2025 values and modify only the carbon-tax input. Since the federal carbon tax was removed beginning in April 2025, we reintroduce the pre-removal tax schedule into the model for all months from 2025-04 onward, while keeping earlier months unchanged. We then forecast the counterfactual price path by feeding the model a tax series that assumes the policy never ended. The difference between the predicted counterfactual price and the actual observed price isolates the marginal effect of the carbon-tax removal on retail gasoline prices.

4.1.2.2 Result

```
# A tibble: 6 x 6
  Province Date       Actual_Price CF_ln_Price CF_Price Price_Difference
  <chr>    <date>            <dbl>       <dbl>    <dbl>            <dbl>
1 Alberta  2025-04-01         128.        4.83     125.            -3.44
2 Alberta  2025-05-01         130.        4.84     127.            -3.62
3 Alberta  2025-06-01         129.        4.84     126.            -3.14
4 Alberta  2025-07-01         128.        4.83     126.            -2.67
5 Alberta  2025-08-01         131.        4.85     128.            -3.24
6 Alberta  2025-09-01         131.        4.85     128.            -3.59
```

The counterfactual analysis compares the observed 2025 gasoline prices against the prices that would have prevailed if the federal carbon tax had remained in place. Across all provinces, the differences between actual and counterfactual prices are small, typically within the range of about 2 to 5 cents per litre. Most provinces would have experienced slightly higher gasoline prices under the counterfactual scenario, indicating that the removal of the carbon tax lowered prices only modestly. For example, Alberta shows a counterfactual price that is higher by roughly 3.4 cents per litre compared with the actual price. This pattern suggests that the effect of carbon tax removal on gasoline prices is limited, and recent price movements are more strongly driven by broader factors such as crude oil markets and general cost conditions captured by CPI. The full counterfactual analysis table could be find in the attachments named "price_cf_results_full,csv".

4.2 Sales Model Interpretation

The model results show that gasoline price, temperature, and vehicle registrations are all statistically significant predictors of gasoline sales. With a p-value $< 2.2e\text{-}16$ for the overall F-test, we reject the null hypothesis that gasoline sales are unrelated to these explanatory variables. The model also achieves an Adjusted R-squared of 0.9978, indicating that approximately 99.78% of the variation in log gasoline sales is explained by the predictors included in the regression.

The elasticity for ln_Price is 0.0319 which indicates by holding all else constant, a 1% increase in gasoline price leads to an estimated 0.0324% increase in gasoline sales. And higher average temperature is linked to a noticeable rise in sales, suggesting that warmer conditions can encourage more driving activity, each 1°C increase in monthly temperature is associated with roughly a 1.5% rise in gasoline sales, while other variables remain unchanged. In contrast, a larger number of registered vehicles slightly reduces monthly fuel sales after controlling for other factors, it tends to 0.38% decrease in gasoline consumption with one percent rise in registered vehilces. This condition might reveals that older cars are being replaced with more fuel-efficient or EVS and lead to a lower consumption. The provincial indicators are also highly significant and capture structural differences in driving patterns and baseline fuel consumption cross regions. Provinces such as New Brunswick, Manitoba and Saskatchewan show lower average gasoline sales relative to the reference group(Alberta), whereas Ontario are $e^{(}1.2525)$ which is approximately 250% higher than Alberta.

4.2.1 Sales Model Counterfactual Analysis

4.2.1.1 Set Up

To evaluate how gasoline consumption would have changed had the federal carbon tax remained in place, we construct a counterfactual scenario using the estimated log–log demand model. The key mechanism is that the carbon tax affects gasoline consumption only through its impact on retail gasoline prices. Therefore, instead of removing the tax directly from the demand equation, we simulate a counterfactual gasoline price for 2025 by adding back the foregone tax (measured in cents per litre) to the observed retail price. Using the estimated price elasticity from the regression model, we then recompute predicted sales under the counterfactual price while holding all other conditions constant, including vehicle registration, temperature, and province fixed effects. The difference between the observed and counterfactual predicted quantities represents the estimated change in gasoline consumption attributable solely to the removal of the carbon tax.

4.2.1.2 Result

```
# A tibble: 11 x 5
   Province                  Actual_Sales   CF_Sales Diff_Sales Diff_Percent
   <chr>                            <dbl>      <dbl>      <dbl>        <dbl>
 1 Alberta                      52968001.  52906390.    -61610.       -0.116
 2 British Columbia             40815594.  40768321.    -47273.       -0.116
 3 Manitoba                     13806326.  13790245.    -16081.       -0.116
 4 New Brunswick                 9429386.   9418392.    -10993.       -0.117
 5 Newfoundland and Labrador     5653321.   5646729.     -6593.       -0.117
 6 Northwest Territories          359323.    358903.      -420.       -0.117
 7 Nova Scotia                  11061802.  11048961.    -12841.       -0.116
 8 Ontario                     138360027. 138199039.   -160989.       -0.116
 9 Prince Edward Island          1874370.   1872186.     -2184.       -0.117
10 Saskatchewan                 14695823.  14678676.    -17147.       -0.117
11 Yukon                          629196.    628465.      -732.       -0.116
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The counterfactual experiment estimates how gasoline demand in each province would have changed if the carbon tax had not been removed, holding all other factors constant. Since the carbon tax increases gasoline prices and the estimated price elasticity in our demand model is negative, the counterfactual scenario predicts slightly lower gasoline sales in every province.

Across provinces, the estimated percentage change in monthly sales (Diff_Percent) ranges narrowly between -0.115% and -0.117%, reflecting the relatively small impact of a one-time price change on short-run gasoline consumption. Provinces with large markets, such as Ontario, Alberta, and British Columbia, show the largest numerical reductions in litres sold (e.g., Ontario: about $-160{,}988$ litres), but the relative reduction is similar across all regions. Smaller provinces (e.g., Northwest Territories or Prince Edward Island) display proportionally identical declines, but with smaller absolute magnitudes due to lower baseline consumption.

4.3 Policy Interpretation and Implications

The results from both the price and demand models indicate that the removal of the federal fuel carbon tax has only a modest effect on gasoline prices and almost no measurable impact on overall consumption patterns. Counterfactual estimates suggest that gasoline prices in 2025 would have been higher by less than one cent per litre in most provinces if the carbon tax had remained in place. Such a small price difference is not large enough to alter driving behaviour or reduce gasoline sales in a meaningful way, especially when compared with much stronger determinants such as global crude oil prices and the number of registered vehicles.

Given that research shows gasoline demand is highly inelastic to price, simply reintroducing a fuel carbon tax based on the existing structure is unlikely to significantly reduce road traffic emissions. The carbon tax has a very low pass-through impact to fuel retail prices, and consumer correspond behavior are weakly, meaning that even with increased tax rates, the short-term emission reduction effect will be very limited. However, from a fiscal and long-term transformation perspective, restoring a fuel carbon tax still meaningful. Model results indicate that its impact on consumer spending is limited, while providing the government with additional fiscal space, which allowing tax revenue to be targeted towards areas with higher emission reduction efficiency.

Therefore, a more effective strategy is not simply to increase fuel tax rates, but to prioritize tax revenue towards emission reduction mechanisms with greater behavioral flexibility. Examples include expanding public transportation systems in major cities(Especially for Downtown Toronto Area), accelerating the adoption of electric vehicles through subsidies and incentives, investing in provincial charging infrastructure, and promoting energy-efficient vehicle models and clean transportation technology innovation. These structural measures are more directly effective in reducing gasoline dependence and vehicle-kilometers of driving, thus creating substantial road traffic emission reductions and better aligning with Canada's long-term net-zero emissions target. Compared to simply raising oil prices, this is a more resilient approach that would help improve Canada's industrial and technological capabilities. Furthermore, given that the public has gradually become accustomed to the existence of the fuel carbon tax system over the past five years, its reinstatement is not expected to trigger a significant social sentiment. Within the framework of the Carney government's infrastructure expansion and energy transition policies, the fuel carbon tax will also help alleviate the government's financial pressure on green transition and infrastructure construction, and will remain consistent with Canada's long-term path towards low-carbon and sustainable development over the next four years.

Appendix

Canada Revenue Agency. 2025. *Fuel Charge Rates. Government of Canada.* https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/fcrates/fuel-charge-rates.html.

Canadian Climate Normals Climate Environment and Climate Change Canada. 2025. *Environment and Climate Change Canada.* https://climate.weather.gc.ca/climate_normals/.

Statistics Canada. 2025a. *Consumer Price Index by Product Group, Monthly, Percentage Change, Not Seasonally Adjusted, Canada, Provinces, Whitehorse, Yellowknife and Iqaluit. Statistics Canada.* https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000413.

———. 2025b. *Monthly Average Retail Prices for Gasoline and Fuel Oil, by Geography. Statistics Canada.* https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000101.

———. 2025c. *Sales of Fuel Used for Road Motor Vehicles, Annual (x 1,000). Statistics Canada.* https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310006601.

———. 2025d. *Vehicle Registrations, by Type of Vehicle and Fuel Type. Statistics Canada.* https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310030801.

Trading Economics. 2025. *Trading Economic. Trading Economics Website.* https://tradingeconomics.com/commodity/crude-oil.

U.S. Energy Information Administration. 2024. *What Countries Are the Top Producers and Consumers of Oil? - FAQ - U.S. Energy Information Administration (EIA). EIA.* https://www.eia.gov/tools/faqs/faq.php?id=709&t=6.