Impact of Weather on Retail Sales in Canada: Clothing and Footwear Industry

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1. Objective

To determine the impact of weather on consumer behavior and retail sales

2. Why?

- Physiological
- Psychological

3. Business Implication

- Potential to improve demand forecasting at Retailer level that can improve major supply chain functions such as
  - Inventory management
  - Material Planning
  - Price Optimization

4. Methodology

- **Dependent Variable:**
  - Monthly Retail Sales for the Clothing and Footwear Industry by QC, ON, and BC
- **Independent Variables:**
  - Total Snow
  - Mean Temperature
  - Total Rain
  - Wind Speed
- **Control Variables:**
  - CPI
  - Unemployment Rate
  - Disposable Income
  - Consumer Confidence

5. EDA

a) Distribution Analysis

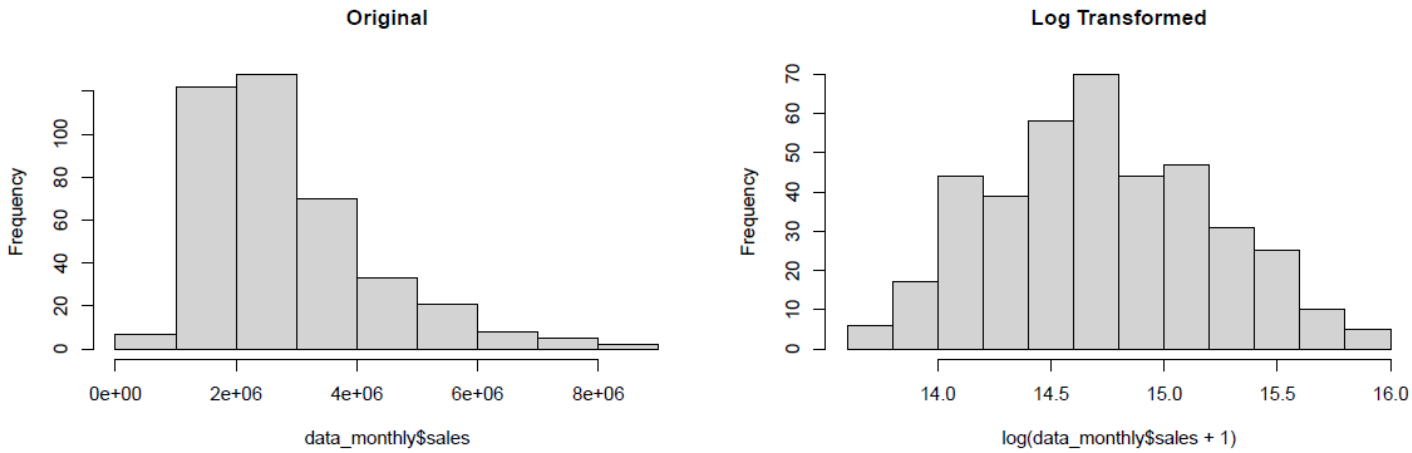

Figure 1: Histogram of Retail Sale

b) Multivariate Analysis

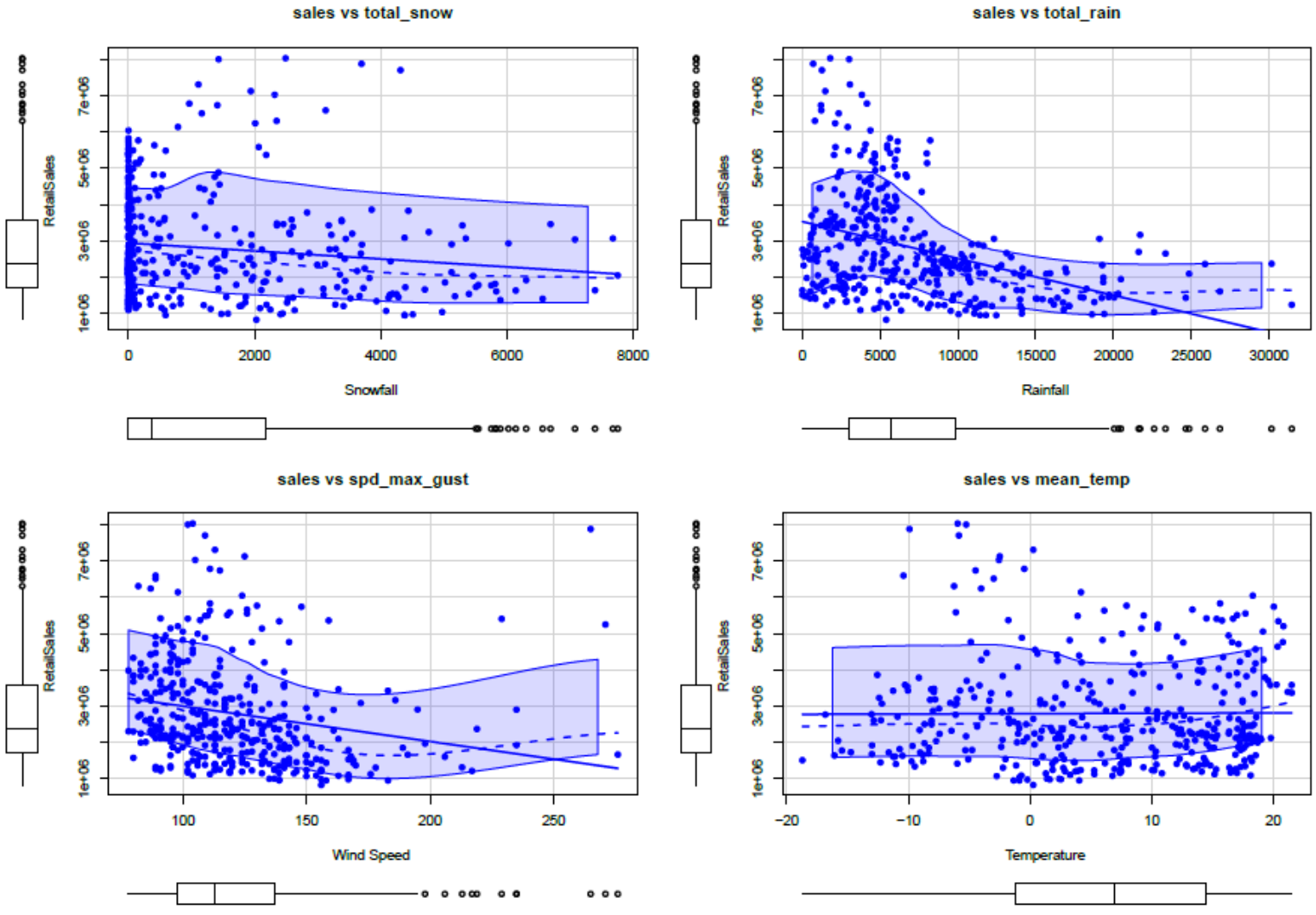

Figure 4: Scatterplots of Sales vs Weather

c) Correlation Matrix

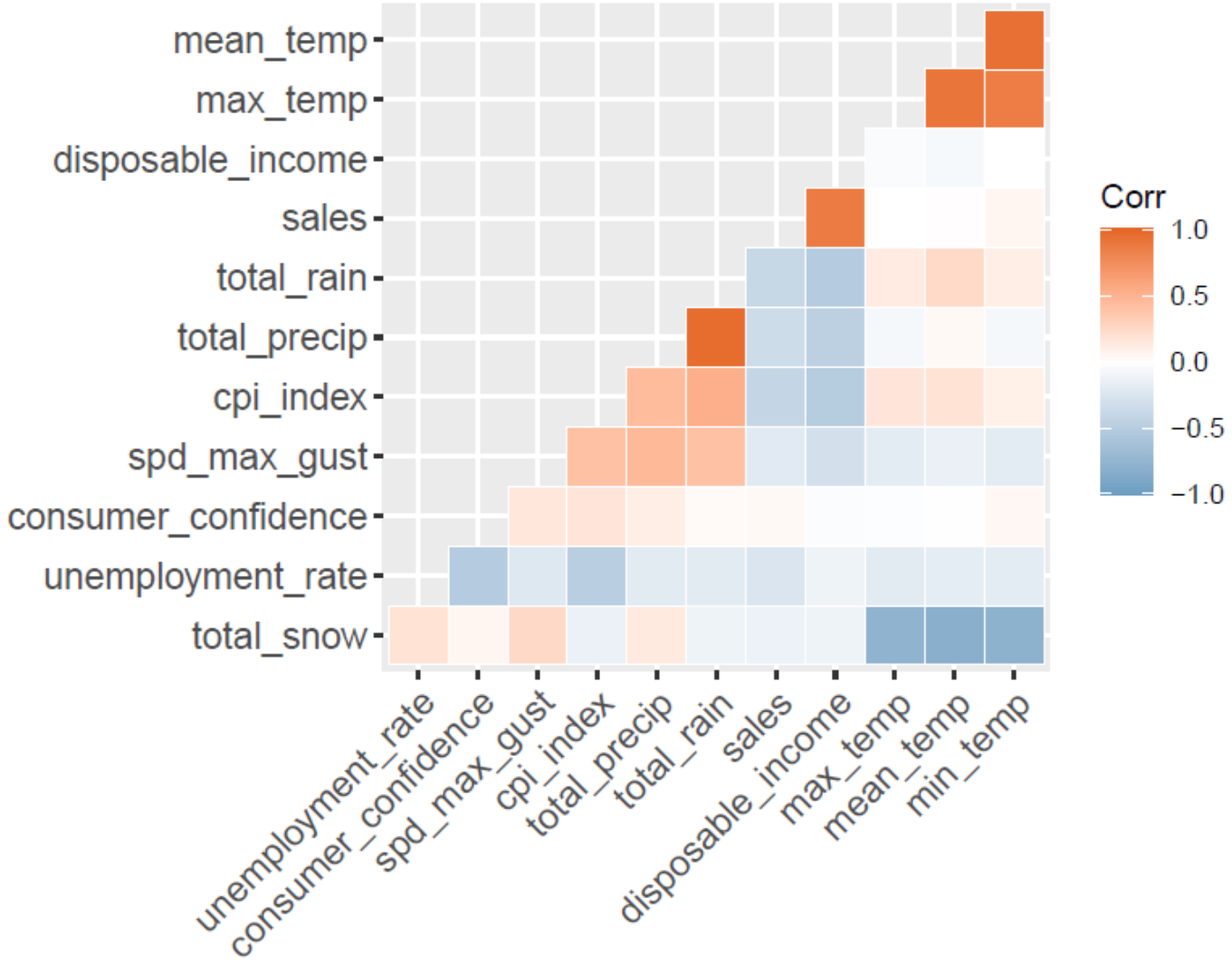

Figure 2: Correlation Heatmap

6. Modelling

a) Result

Table 3: Regression Table

	Dependent variable:			
	sales			
	(1)	(2)	(3)	(4)
consumer_confidence	0.095*** (0.019)			
cpi_index		−0.159*** (0.024)		
disposable_income			0.424*** (0.010)	
unemployment_rate				−0.146*** (0.019)
total_snow	−0.191*** (0.044)	−0.196*** (0.043)	−0.044** (0.020)	−0.155*** (0.043)
total_rain	−0.225*** (0.030)	−0.200*** (0.030)	−0.015 (0.015)	−0.228*** (0.029)
mean_temp	−0.051 (0.037)	−0.038 (0.036)	0.045*** (0.017)	−0.055 (0.036)
spd_max_gust	−0.105*** (0.030)	−0.014 (0.031)	−0.015 (0.014)	−0.133*** (0.029)
winter	0.693*** (0.125)	0.613*** (0.123)	0.500*** (0.056)	0.572*** (0.121)
I(mean_temp^2)	−0.044* (0.024)	−0.084*** (0.025)	−0.049*** (0.011)	−0.025 (0.024)
total_rain:winter	0.062 (0.067)	0.073 (0.066)	−0.034 (0.030)	0.048 (0.065)
total_snow:winter	0.030 (0.105)	0.043 (0.103)	0.087* (0.047)	0.051 (0.101)
spd_max_gust:winter	−0.098 (0.095)	−0.068 (0.093)	0.002 (0.043)	−0.053 (0.091)
Constant	14.692*** (0.031)	14.744*** (0.032)	14.722*** (0.014)	14.679*** (0.030)
Observations	396	396	396	396
R^2	0.441	0.465	0.887	0.482
Adjusted R^2	0.426	0.451	0.884	0.468
Residual Std. Error (df = 385)	0.369	0.361	0.166	0.355
F Statistic (df = 10; 385)	30.340***	33.416***	302.359***	35.791***
Note:				*p<0.1; **p<0.05; ***p<0.01

b) Validation

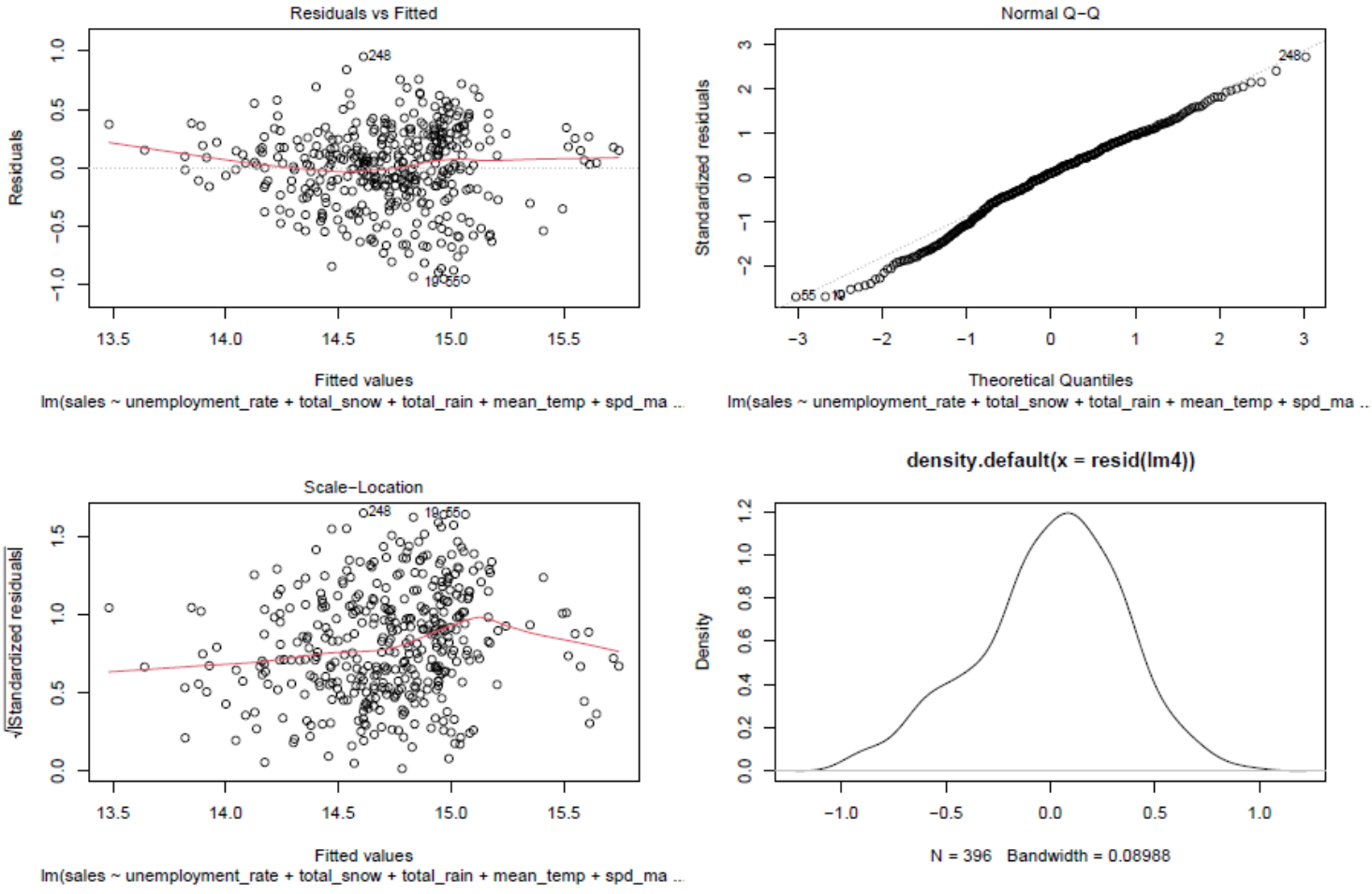

Figure 5: Model Validation

7. Conclusion

- H1: Retail Sales decreases with rainfall ✓
- H2: Retail Sales decreases with snowfall ✓
- H3: Retail Sales decreases with wind speed ✓
- H4: Retail Sales is negatively related to mean temperature X

8. Limitations

- Research focus on offline retail sales
- No distinction between street side stores and mall stores
- Few weather parameters were not considered
- Monthly aggregation data was considered