Walmart Historical Data Analysis

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INTRODUCTION

Terms

- CPI (Consumer Price Index) - represents changes in prices as experienced by consumers. It measures price change by comparing, through time, the cost of a fixed basket of goods and services.

- Holidays - for the purpose of this project, the term “holidays” refer strictly to New Year’s Eve, Christmas, Thanksgiving, and Independence Day

- Holiday Week - refers to a week that encompasses any of the holidays being considered in this project

- Regular Week/Non-holiday Week - refers to a week that does not encompass any of the four holidays being considered in this project

Questions and Assumptions

We aimed to answer the following questions:

1. Is there a difference in weekly sales between a holiday and a regular week?
2. What is the effect of CPI on weekly sales during holiday and regular weeks?
3. How does temperature fluctuations affect weekly sales during holiday and regular weeks?
4. Do changes in fuel price affect weekly sales during holiday and regular weeks?
5. Do unemployment rates affect weekly sales during holiday and regular weeks?

Hypotheses:

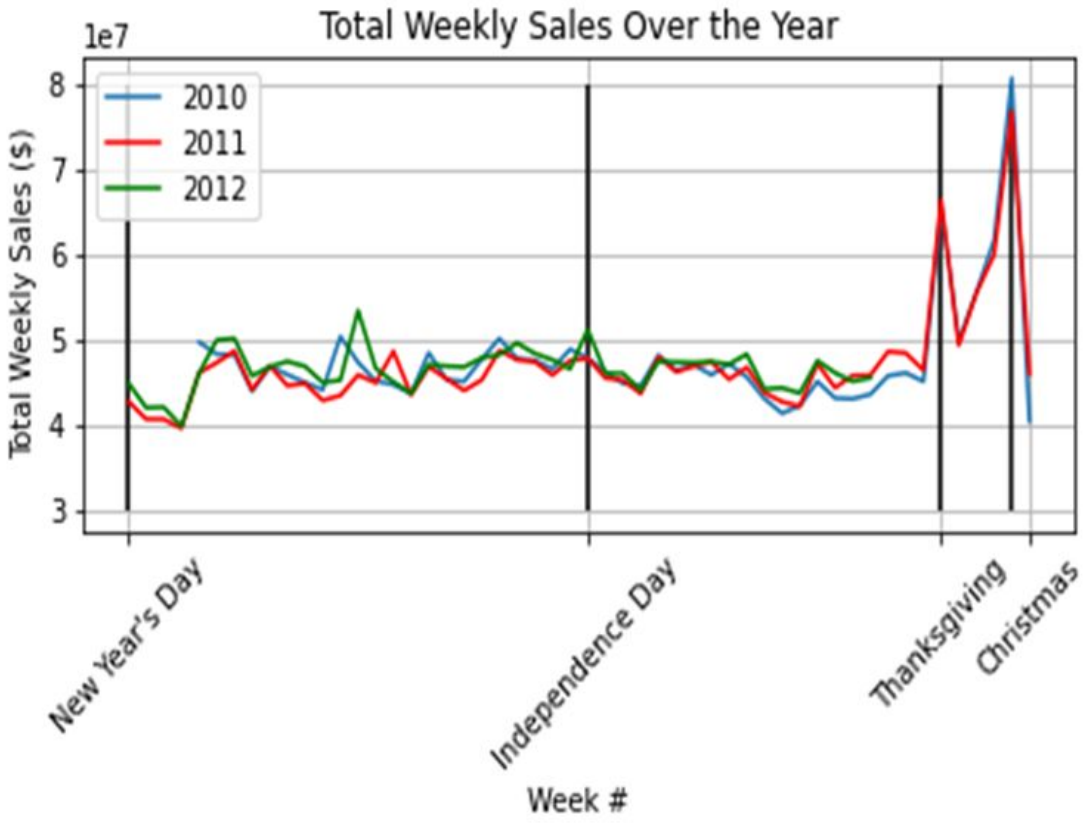
1. Holiday weekly sales are higher than regular weekly sales;
2. Increased CPI results in decreased weekly sales, while a decrease in CPI results in increased weekly sales, whether or not the week is a holiday week or a regular week;
3. Cold temperatures have low weekly sales and warmer temperatures have higher sales both during the holiday and non-holiday weeks;
4. Increased fuel price results in decreased weekly sales, whether or not the week is a holiday week or regular week;
5. High unemployment rates leads to decreased weekly sales, whether or not the week is a holiday week or regular week.

RESULTS AND IMPLICATIONS

Holiday Week vs Regular Week

The results obtained conform with our hypothesis that weekly sales are higher during holiday weeks than on regular weeks. Weekly sales spiked during the New Year's, Independence Day, Thanksgiving and Christmas. The largest spikes are observed during Christmas and Thanksgiving. These results reaffirm what we already know about normal consumer behavior, wherein people spend more during holidays.

Figure 1. Annual Total Weekly Sales

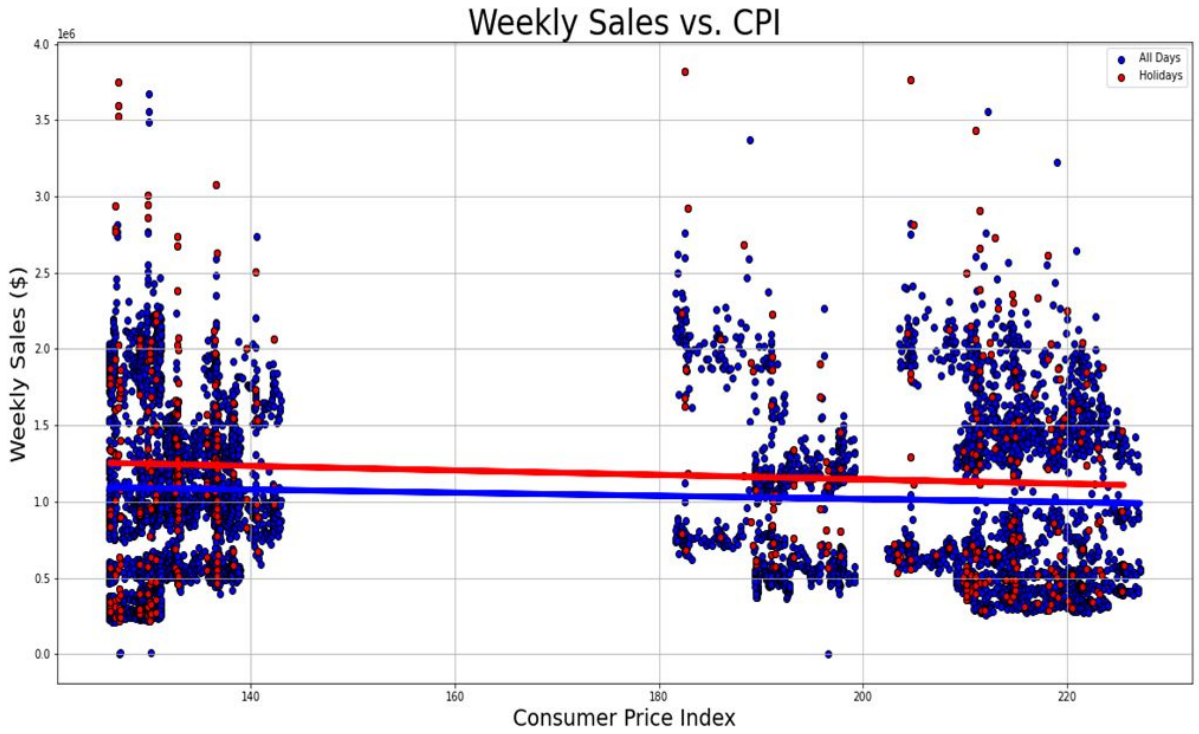


Consumer Price Index

From the scatter plot, a trend is not readily observable between CPI and weekly sales. A linear regression analysis confirmed a negative relationship between CPI and weekly sales. This is expected because an increase in CPI implies that it is more costly to maintain the same standard of living.

With respect to weekly sales during the holidays, the relationship appears to be mainly static. Higher CPI means that necessity goods are more expensive than normal, which can dissuade a consumer from purchasing luxury goods, for example, a high-specs TV.

Figure 2. Weekly Sales vs Consumer Price Index



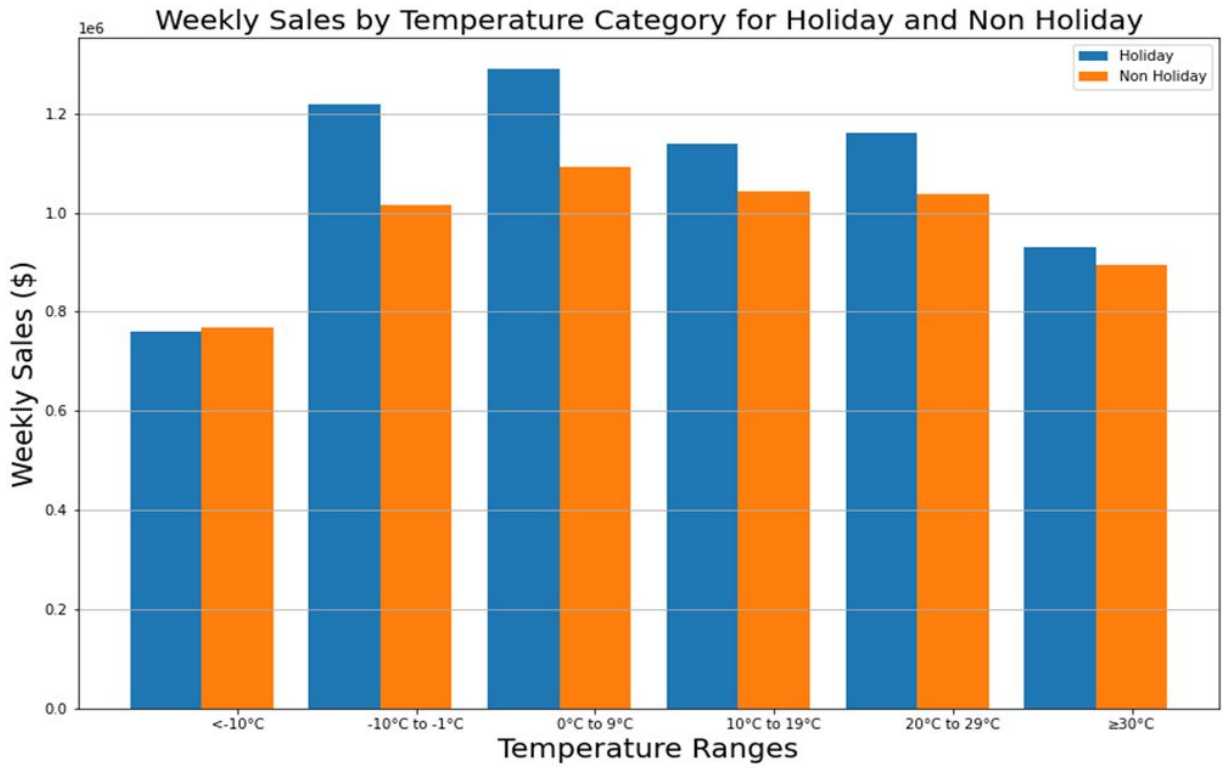
Temperature

Using linear regression on a scatter plot, a negative relationship between temperature and weekly sales is shown. However, the r-value of -0.06 indicates further that the model used was not a good fit for the data, prompting us to reexamine the data.

After reviewing average weekly sales with respect to temperature, it showed us that the lowest weekly sales were observed when temperatures are lower than -10 degrees Celsius. However, the negative relationship is skewed because temperatures ranging from -10 to 10 degrees Celsius have higher weekly sales compared to when the temperatures are less than -10 degrees Celsius and beyond 10 degrees Celsius.

The results conform to the first part of our assumption that extremely cold weather leads to lower weekly sales than during mild temperatures for both holiday and non-holiday weeks.

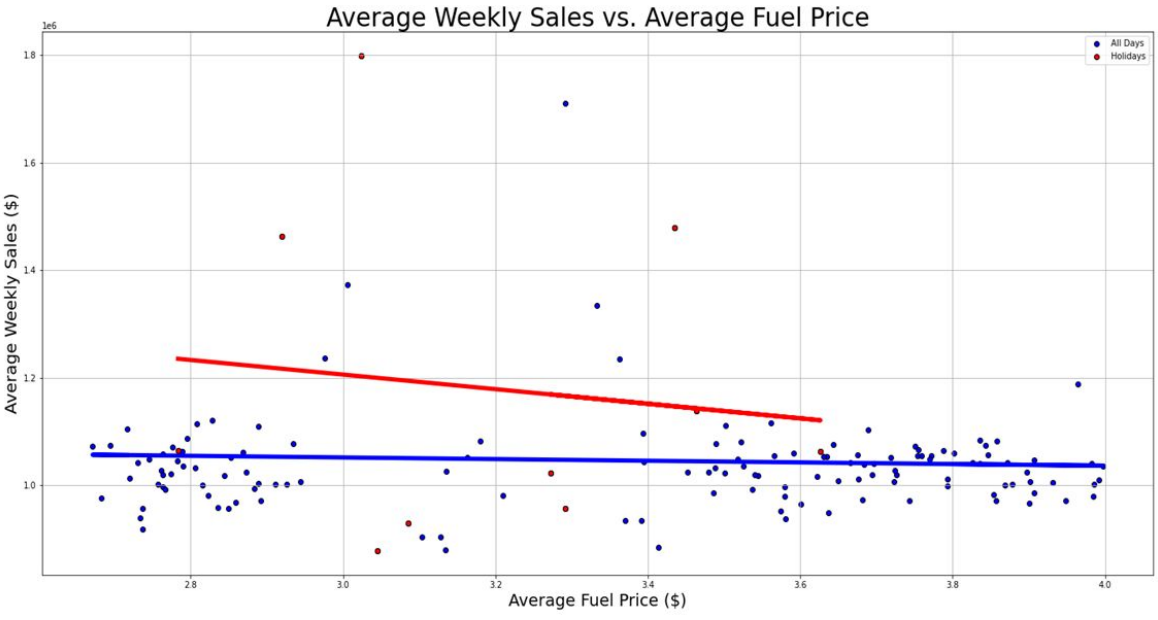
Figure 3. Average Weekly Sales by Temperature Clusters for Holiday and Non-holiday Weeks



Fuel Price

Average weekly sales for non-holiday weeks appear to be unaffected by fuel price. In contrast, average weekly sales for holiday weeks decrease as fuel prices increase. On non-holidays, grocery shopping is a routine activity that is accomplished regardless of fuel prices. However, holiday shopping is considered a non-routine activity and consumers may pay greater attention to fuel prices and their shopping habits.

Figure 4. Average Weekly Sales vs Fuel Price

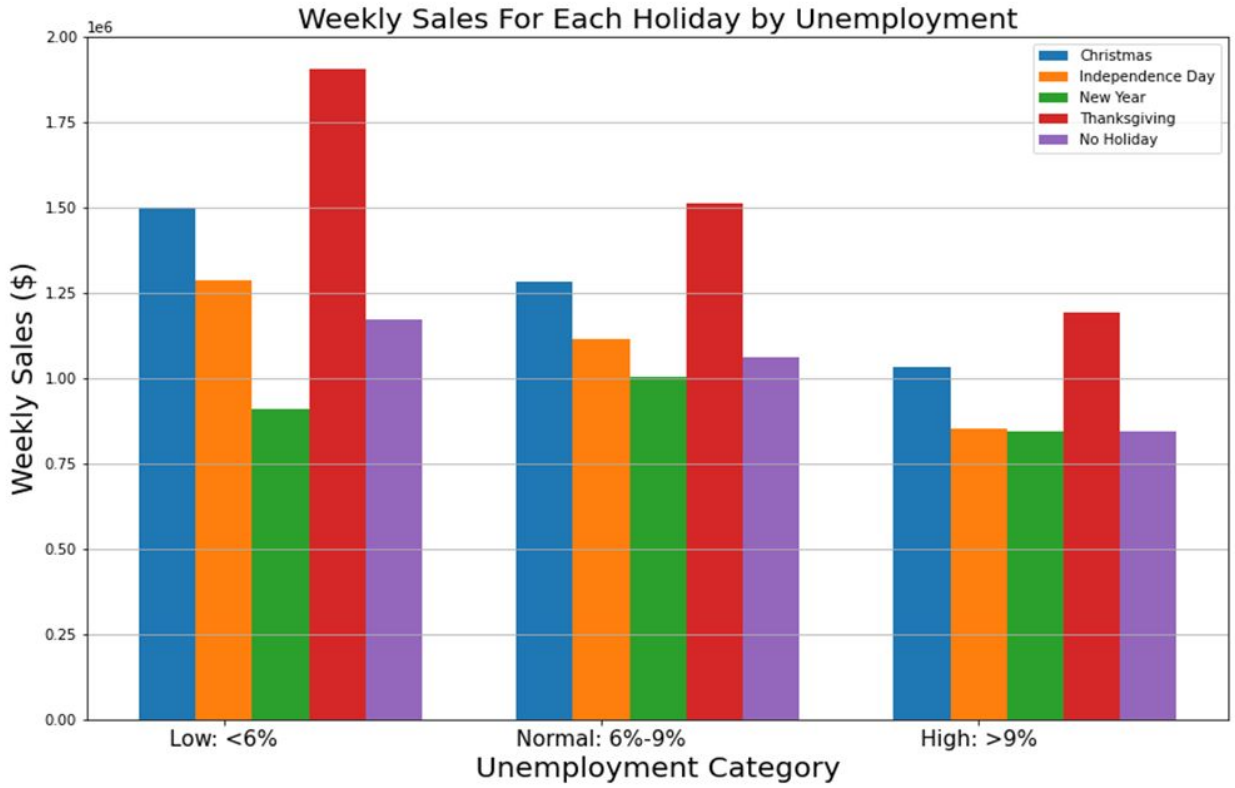


Unemployment Rate

Linear regression analysis confirms a negative relationship between weekly sales and unemployment rate, for both holiday and non-holiday weeks. Weekly sales decrease when unemployment rate increases. However, it is noticeable that weekly sales during holidays are still higher when compared to regular weeks. Specifically, highest weekly sales are observed during Thanksgiving and Christmas.

Socio-cultural practices of celebrating joyous occasions and extolling virtues of generosity during holidays can be factors that encourage consumers to spend regardless of the lack of a stable income source.

Figure 5. Weekly Sales for Each Holiday vs Unemployment Rates



SUMMARY

- Weekly sales are generally higher during holiday weeks than on regular weeks
- Increased CPI, fuel price, and unemployment rates results in decreased weekly sales
- Extremely cold temperatures results in decreased weekly sales