Project 4 Retail Analysis with Walmart data

DESCRIPTION

One of the leading retail stores in the US, Walmart, would like to predict the sales and demand accurately. There are certain events and holidays which impact sales on each day. There are sales data available for 45 stores of Walmart. The business is facing a challenge due to unforeseen demands and runs out of stock some times, due to the inappropriate machine learning algorithm. An ideal ML algorithm will predict demand accurately and ingest factors like economic conditions including CPI, Unemployment Index, etc.

Walmart runs several promotional markdown events throughout the year. These markdowns precede prominent holidays, the four largest of all, which are the Super Bowl, Labour Day, Thanksgiving, and Christmas. The weeks including these holidays are weighted five times higher in the evaluation than non-holiday weeks. Part of the challenge presented by this competition is modeling the effects of markdowns on these holiday weeks in the absence of complete/ideal historical data. Historical sales data for 45 Walmart stores located in different regions are available.

Dataset Description

This is the historical data that covers sales from 2010-02-05 to 2012-11-01, in the file Walmart_Store_sales. Within this file you will find the following fields:

1. Store - the store number
2. Date - the week of sales
3. Weekly_Sales - sales for the given store
4. Holiday_Flag - whether the week is a special holiday week 1 – Holiday week 0 – Non-holiday week
5. Temperature - Temperature on the day of sale
6. Fuel_Price - Cost of fuel in the region
7. CPI – Prevailing consumer price index
8. Unemployment - Prevailing unemployment rate

Holiday Events

Super Bowl: 12-Feb-10, 11-Feb-11, 10-Feb-12, 8-Feb-13 Labour Day: 10-Sep-10, 9-Sep-11, 7-Sep-12, 6-Sep-13 Thanksgiving: 26-Nov-10, 25-Nov-11, 23-Nov-12, 29-Nov-13 Christmas: 31-Dec-10, 30-Dec-11, 28-Dec-12, 27-Dec-13

Analysis Tasks

Basic Statistics tasks

1. Which store has maximum sales
2. Which store has maximum standard deviation i.e., the sales vary a lot. Also, find out the coefficient of mean to standard deviation
3. Which store/s has good quarterly growth rate in Q3’2012

4. Some holidays have a negative impact on sales. Find out holidays which have higher sales than the mean sales in non-holiday season for all stores together

5. Provide a monthly and semester view of sales in units and give insights

6. Statistical Model

For Store 1 – Build prediction models to forecast demand

Linear Regression – Utilize variables like date and restructure dates as 1 for 5 Feb 2010 (starting from the earliest date in order). Hypothesize if CPI, unemployment, and fuel price have any impact on sales.

Change dates into days by creating new variable.

Select the model which gives best accuracy.

In [1]:

```
# Import necessary libraries
import pandas as pd
import seaborn as sns
import numpy as np
import matplotlib.pyplot as plt
from matplotlib import dates
from datetime import datetime
```

In [2]:

```
# Load dataset
data = pd.read_csv('Walmart_Store_sales.csv')
data
```

Out[2]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment
0	1	05-02-2010	1643690.90	0	42.31	2.572	211.096358	8.106
1	1	12-02-2010	1641957.44	1	38.51	2.548	211.242170	8.106
2	1	19-02-2010	1611968.17	0	39.93	2.514	211.289143	8.106
3	1	26-02-2010	1409727.59	0	46.63	2.561	211.319643	8.106

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment
4	1	05-03-2010	1554806.68	0	46.50	2.625	211.350143	8.106
...	...	...	...	...	...	...	...	...
6430	45	28-09-2012	713173.95	0	64.88	3.997	192.013558	8.684
6431	45	05-10-2012	733455.07	0	64.89	3.985	192.170412	8.667
6432	45	12-10-2012	734464.36	0	54.47	4.000	192.327265	8.667
6433	45	19-10-2012	718125.53	0	56.47	3.969	192.330854	8.667
6434	45	26-10-2012	760281.43	0	58.85	3.882	192.308899	8.667

6435 rows × 8 columns

Data Preparation

In [3]:

```
# Convert date to datetime format
data['Date'] =  pd.to_datetime(data['Date'])
data.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6435 entries, 0 to 6434
Data columns (total 8 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   Store         6435 non-null   int64
 1   Date          6435 non-null   datetime64[ns]
 2   Weekly_Sales  6435 non-null   float64
 3   Holiday_Flag  6435 non-null   int64
 4   Temperature   6435 non-null   float64
```

```
 5   Fuel_Price    6435 non-null   float64
 6   CPI           6435 non-null   float64
 7   Unemployment  6435 non-null   float64
dtypes: datetime64[ns](1), float64(5), int64(2)
memory usage: 402.3 KB
```

In [4]:

```
# check for missing values
data.isnull().sum()
```

Out[4]:

```
Store           0
Date            0
Weekly_Sales    0
Holiday_Flag    0
Temperature     0
Fuel_Price      0
CPI             0
Unemployment    0
dtype: int64
```

In [5]:

```
# Splitting Date and creating new columns (Day, Month, and Year)
data["Day"]= pd.DatetimeIndex(data['Date']).day
data['Month'] = pd.DatetimeIndex(data['Date']).month
data['Year'] = pd.DatetimeIndex(data['Date']).year
data
```

Out[5]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	Day	Month	Year
0	1	2010-05-02	1643690.90	0	42.31	2.572	211.096358	8.106	2	5	2010
1	1	2010-12-02	1641957.44	1	38.51	2.548	211.242170	8.106	2	12	2010
2	1	2010-02-19	1611968.17	0	39.93	2.514	211.289143	8.106	19	2	2010
3	1	2010-02-26	1409727.59	0	46.63	2.561	211.319643	8.106	26	2	2010
4	1	2010-05-03	1554806.68	0	46.50	2.625	211.350143	8.106	3	5	2010

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	Day	Month	Year
...	...	...	...	...	...	...	...	...	...	...	...
6430	45	2012-09-28	713173.95	0	64.88	3.997	192.013558	8.684	28	9	2012
6431	45	2012-05-10	733455.07	0	64.89	3.985	192.170412	8.667	10	5	2012
6432	45	2012-12-10	734464.36	0	54.47	4.000	192.327265	8.667	10	12	2012
6433	45	2012-10-19	718125.53	0	56.47	3.969	192.330854	8.667	19	10	2012
6434	45	2012-10-26	760281.43	0	58.85	3.882	192.308899	8.667	26	10	2012

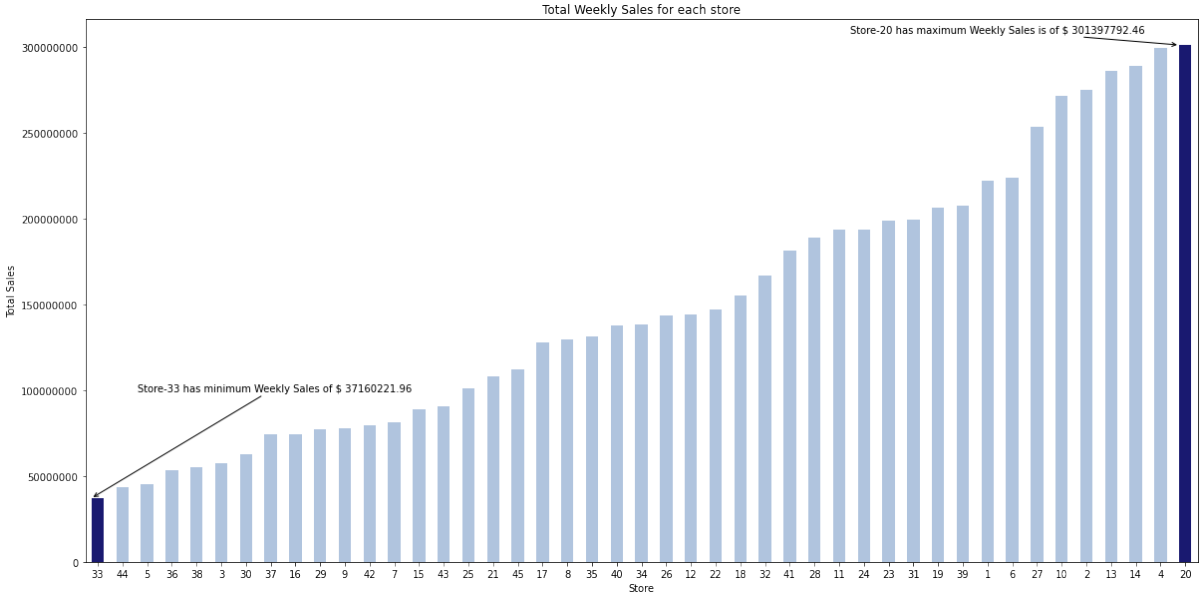
6435 rows × 11 columns

Q1: Which store has minimum and maximum sales?

In [6]:

```
plt.figure(figsize=(20,10))

# Sum Weekly_Sales for each store, then sortded by total sales
total_sales_for_each_store =
data.groupby('Store')['Weekly_Sales'].sum().sort_values()
total_sales_for_each_store_array = np.array(total_sales_for_each_store) #
convert to array

# Assigning a specific color for the stores have the lowest and highest
sales
clrs = ['lightsteelblue' if ((x < max(total_sales_for_each_store_array))
and (x > min(total_sales_for_each_store_array))) else 'midnightblue' for x
in total_sales_for_each_store_array]


ax = total_sales_for_each_store.plot(kind='bar',color=clrs);

# store have minimum sales
```

```
p = ax.patches[0]
print(type(p.get_height()))
ax.annotate("Store-33 has minimum Weekly Sales of $
{0:.2f}".format((p.get_height())), xy=(p.get_x(), p.get_height()),
xycoords='data',
            xytext=(0.17, 0.32), textcoords='axes fraction',
            arrowprops=dict(arrowstyle="->", connectionstyle="arc3"),
            horizontalalignment='center', verticalalignment='center')


# store have maximum sales
p = ax.patches[44]
ax.annotate("Store-20 has maximum Weekly Sales is of $
{0:.2f}".format((p.get_height())), xy=(p.get_x(), p.get_height()),
xycoords='data',
            xytext=(0.82, 0.98), textcoords='axes fraction',
            arrowprops=dict(arrowstyle="->", connectionstyle="arc3"),
            horizontalalignment='center', verticalalignment='center')


# plot properties
plt.xticks(rotation=0)
plt.ticklabel_format(useOffset=False, style='plain', axis='y')
plt.title('Total Weekly Sales for each store')
plt.xlabel('Store')
plt.ylabel('Total Sales');
<class 'numpy.float64'>
```



Q2: Which store has maximum standard deviation i.e., the sales vary a lot. Also, find out the coefficient of mean to standard deviation?

In [7]:

```
# Which store has maximum standard deviation
data_std =
pd.DataFrame(data.groupby('Store')['Weekly_Sales'].std().sort_values(ascend
ing=False))
```

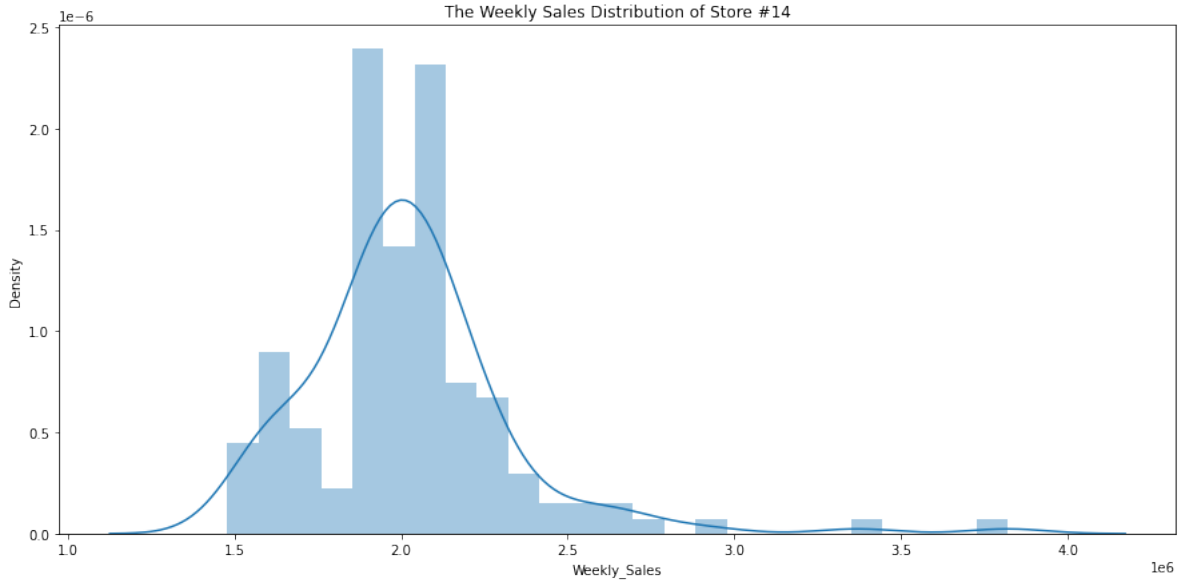
```
print("The store with maximum standard deviation is
"+str(data_std.head(1).index[0])+" with $
{0:.0f}".format(data_std.head(1).Weekly_Sales[data_std.head(1).index[0]]))
```

```
The store with maximum standard deviation is 14 with $ 317570
```

In [8]:

```
# Distribution of store has maximum standard deviation
plt.figure(figsize=(15,7))
sns.distplot(data[data['Store'] ==
data_std.head(1).index[0]]['Weekly_Sales'])
plt.title('The Weekly Sales Distribution of Store #'+
str(data_std.head(1).index[0]));
```

```
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/distributions.p
y:2551: FutureWarning: `distplot` is a deprecated function and will be remo
ved in a future version. Please adapt your code to use either `displot` (a
figure-level function with similar flexibility) or `histplot` (an axes-leve
l function for histograms).
  warnings.warn(msg, FutureWarning)
```



In [9]:

```
# Coefficient of mean to standard deviation
coef_mean_std = pd.DataFrame(data.groupby('Store')['Weekly_Sales'].std() /
data.groupby('Store')['Weekly_Sales'].mean())
coef_mean_std = coef_mean_std.rename(columns={'Weekly_Sales':'Coefficient
of mean to standard deviation'})
coef_mean_std
```

Out[9]:

Store	Coefficient of mean to standard deviation
1	0.100292
2	0.123424
3	0.115021

Store	Coefficient of mean to standard deviation
4	0.127083
5	0.118668
6	0.135823
7	0.197305
8	0.116953
9	0.126895
10	0.159133
11	0.122262
12	0.137925
13	0.132514
14	0.157137
15	0.193384
16	0.165181
17	0.125521
18	0.162845
19	0.132680
20	0.130903
21	0.170292

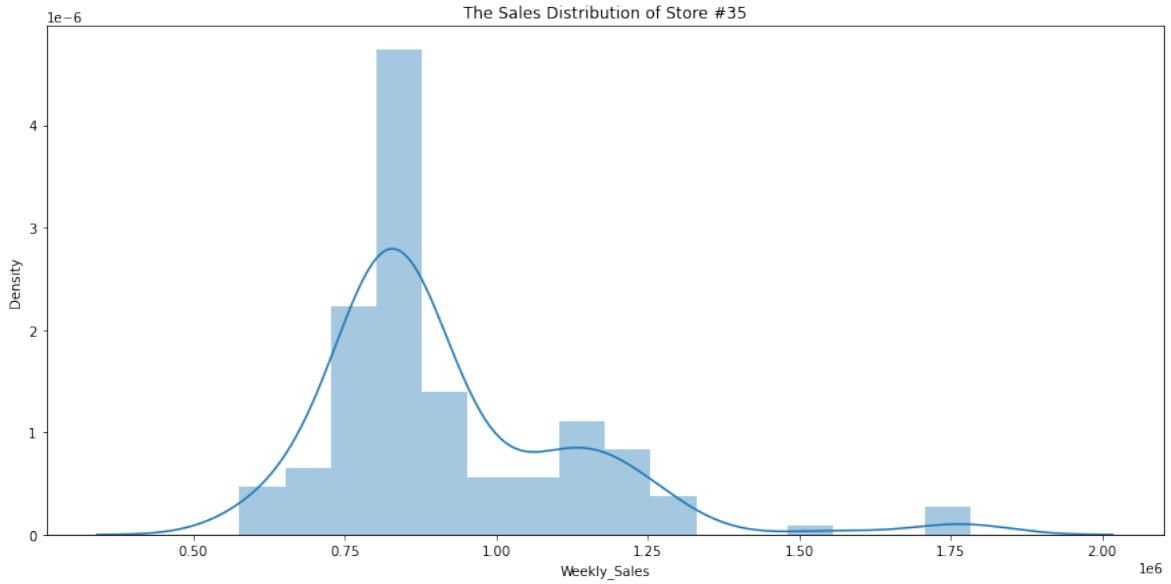
Store	Coefficient of mean to standard deviation
22	0.156783
23	0.179721
24	0.123637
25	0.159860
26	0.110111
27	0.135155
28	0.137330
29	0.183742
30	0.052008
31	0.090161
32	0.118310
33	0.092868
34	0.108225
35	0.229681
36	0.162579
37	0.042084
38	0.110875
39	0.149908

Coefficient of mean to standard deviation

Store	
40	0.123430
41	0.148177
42	0.090335
43	0.064104
44	0.081793
45	0.165613

In [10]:

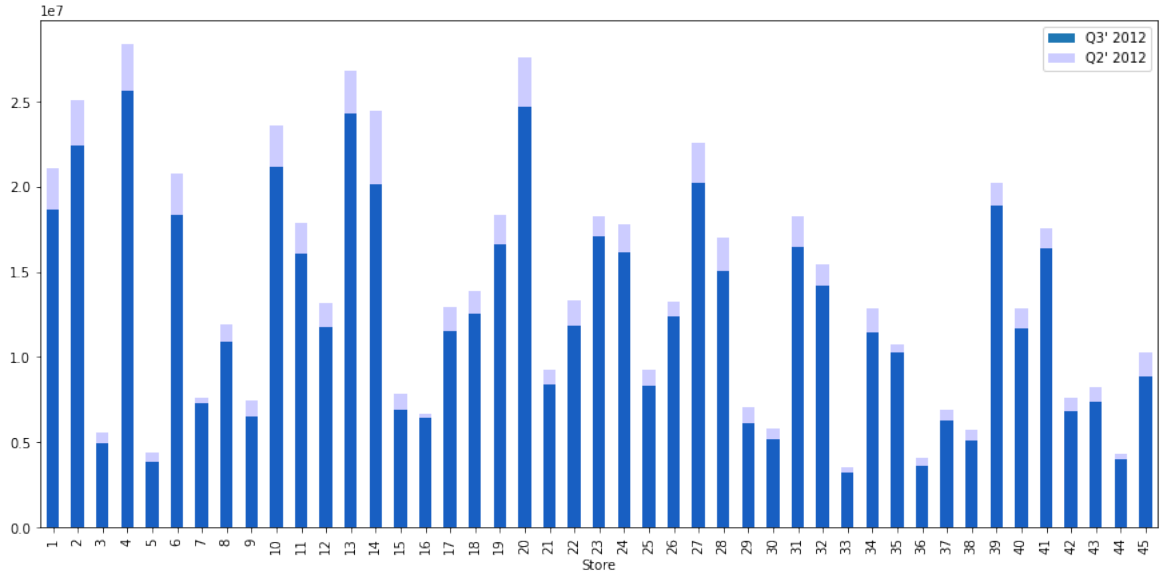
```
# Distribution of store has maximum coefficient of mean to standard
deviation
coef_mean_std_max = coef_mean_std.sort_values(by='Coefficient of mean to
standard deviation')
plt.figure(figsize=(15,7))
sns.distplot(data[data['Store'] ==
coef_mean_std_max.tail(1).index[0]]['Weekly_Sales'])
plt.title('The Sales Distribution of Store
#'+str(coef_mean_std_max.tail(1).index[0]));
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/distributions.p
y:2551: FutureWarning: `distplot` is a deprecated function and will be remo
ved in a future version. Please adapt your code to use either `displot` (a
figure-level function with similar flexibility) or `histplot` (an axes-leve
l function for histograms).
  warnings.warn(msg, FutureWarning)
```



Q3: Which store has good quarterly growth rate in Q3' 2012

In [11]:

```
plt.figure(figsize=(15,7))

# Sales for third quarterly in 2012
Q3 = data[(data['Date'] > '2012-07-01') & (data['Date'] < '2012-09-
30')].groupby('Store')['Weekly_Sales'].sum()

# Sales for second quarterly in 2012
Q2 = data[(data['Date'] > '2012-04-01') & (data['Date'] < '2012-06-
30')].groupby('Store')['Weekly_Sales'].sum()

# Plotting the difference between sales for second and third quarterly
Q2.plot(ax=Q3.plot(kind='bar',legend=True),kind='bar',color='b',alpha=0.2,l
egend=True);
plt.legend(["Q3' 2012", "Q2' 2012"]);
```



In [12]:

```
#  store/s has good quarterly growth rate in Q3'2012 -
.sort_values(by='Weekly_Sales')
print('Store with good quarterly growth rate in Q3'2012 is Store
'+str(Q3.idxmax())+' with $ '+str(Q3.max()))
Store with good quarterly growth rate in Q3'2012 is Store 4 with $ 25652119
.35
```

Q4: Some holidays have a negative impact on sales. Find out holidays which have higher sales than the mean sales in non-holiday season for all stores together

Holiday Events:

Super Bowl: 12-Feb-10, 11-Feb-11, 10-Feb-12, 8-Feb-13

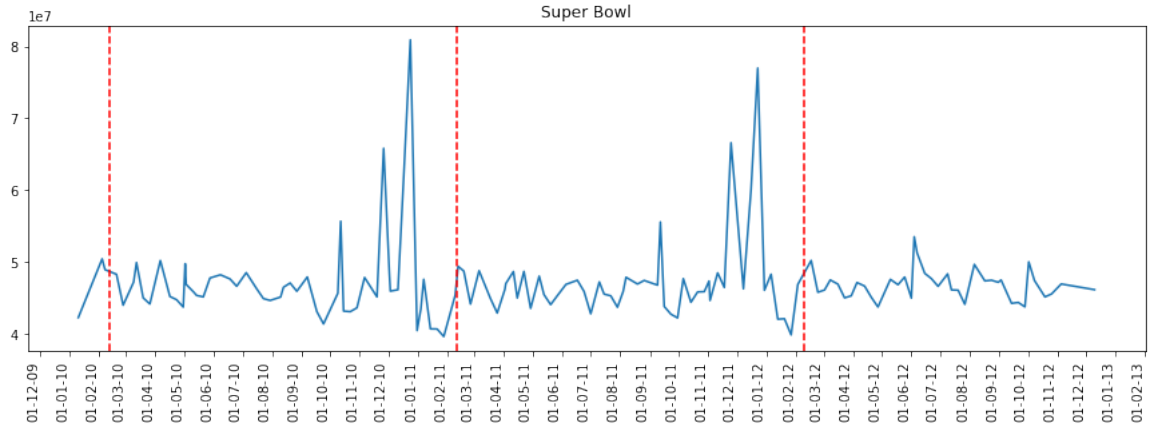
Labour Day: 10-Sep-10, 9-Sep-11, 7-Sep-12, 6-Sep-13

Thanksgiving: 26-Nov-10, 25-Nov-11, 23-Nov-12, 29-Nov-13

Christmas: 31-Dec-10, 30-Dec-11, 28-Dec-12, 27-Dec-13

In [13]:

```
def plot_line(df,holiday_dates,holiday_label):
    fig, ax = plt.subplots(figsize = (15,5))
    ax.plot(df['Date'],df['Weekly_Sales'],label=holiday_label)

    for day in holiday_dates:
        day = datetime.strptime(day, '%d-%m-%Y')
        plt.axvline(x=day, linestyle='--', c='r')


    plt.title(holiday_label)
    x_dates = df['Date'].dt.strftime('%Y-%m-%d').sort_values().unique()
    xfmt = dates.DateFormatter('%d-%m-%y')
    ax.xaxis.set_major_formatter(xfmt)
    ax.xaxis.set_major_locator(dates.DayLocator(1))
    plt.gcf().autofmt_xdate(rotation=90)
    plt.show()


total_sales = data.groupby('Date')['Weekly_Sales'].sum().reset_index()
Super_Bowl =['12-2-2010', '11-2-2011', '10-2-2012']
Labour_Day =  ['10-9-2010', '9-9-2011', '7-9-2012']
Thanksgiving =  ['26-11-2010', '25-11-2011', '23-11-2012']
Christmas = ['31-12-2010', '30-12-2011', '28-12-2012']

plot_line(total_sales,Super_Bowl,'Super Bowl')
plot_line(total_sales,Labour_Day,'Labour Day')
plot_line(total_sales,Thanksgiving,'Thanksgiving')
plot_line(total_sales,Christmas,'Christmas')
```



The sales increased during Thanksgiving and Christmas.

In [14]:

```
data.loc[data.Date.isin(Super_Bowl)]
```

Out[14]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	Day	Month	Year
1	1	2010-12-02	1641957.44	1	38.51	2.548	211.242170	8.106	2	12	2010

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	Day	Month	Year
53	1	2011-11-02	1649614.93	1	36.39	3.022	212.936705	7.742	2	11	2011
105	1	2012-10-02	1802477.43	1	48.02	3.409	220.265178	7.348	2	10	2012
144	2	2010-12-02	2137809.50	1	38.49	2.548	210.897994	8.324	2	12	2010
196	2	2011-11-02	2168041.61	1	33.19	3.022	212.592862	8.028	2	11	2011
...	...	...	...	...	...	...	...	...	...	...	...
6202	44	2011-11-02	307486.73	1	30.83	3.034	127.859129	7.224	2	11	2011
6254	44	2012-10-02	325377.97	1	33.73	3.116	130.384903	5.774	2	10	2012
6293	45	2010-12-02	656988.64	1	27.73	2.773	181.982317	8.992	2	12	2010
6345	45	2011-11-02	766456.00	1	30.30	3.239	183.701613	8.549	2	11	2011
6397	45	2012-10-02	803657.12	1	37.00	3.640	189.707605	8.424	2	10	2012

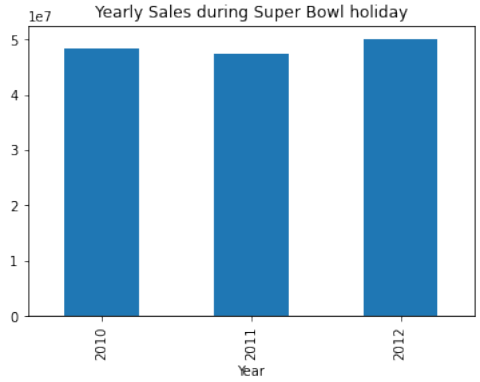
135 rows × 11 columns

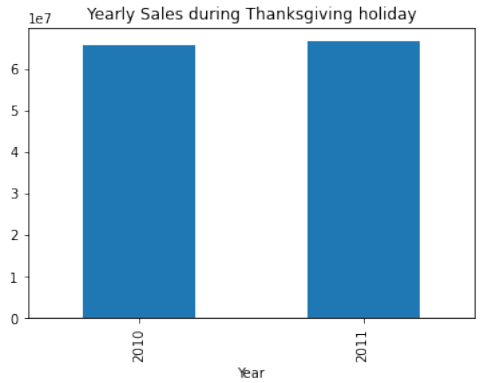
In [15]:

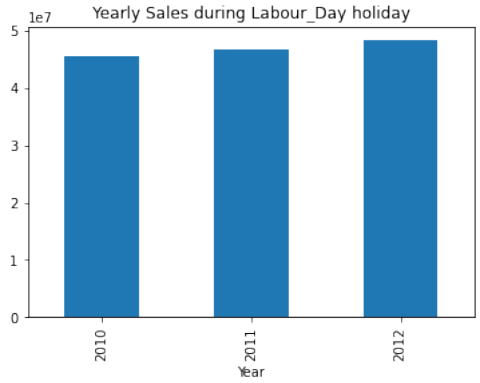
```
# Yearly Sales in holidays
Super_Bowl_df =
pd.DataFrame(data.loc[data.Date.isin(Super_Bowl)].groupby('Year')['Weekly_S
ales'].sum())
Thanksgiving_df =
pd.DataFrame(data.loc[data.Date.isin(Thanksgiving)].groupby('Year')['Weekly
_Sales'].sum())
Labour_Day_df =
pd.DataFrame(data.loc[data.Date.isin(Labour_Day)].groupby('Year')['Weekly_S
ales'].sum())
Christmas_df =
pd.DataFrame(data.loc[data.Date.isin(Christmas)].groupby('Year')['Weekly_Sa
les'].sum())

Super_Bowl_df.plot(kind='bar',legend=False,title='Yearly Sales during Super
Bowl holiday')
Thanksgiving_df.plot(kind='bar',legend=False,title='Yearly Sales during
Thanksgiving holiday')
Labour_Day_df.plot(kind='bar',legend=False,title='Yearly Sales during
Labour_Day holiday')
Christmas_df.plot(kind='bar',legend=False,title='Yearly Sales during
Christmas holiday')
```

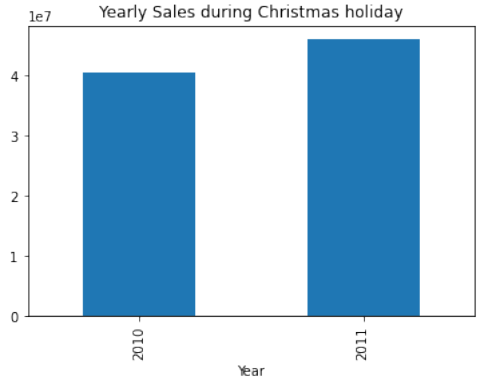
Out[15]:

```
<AxesSubplot:title={'center':'Yearly Sales during Christmas holiday'}, xlab
el='Year'>
```





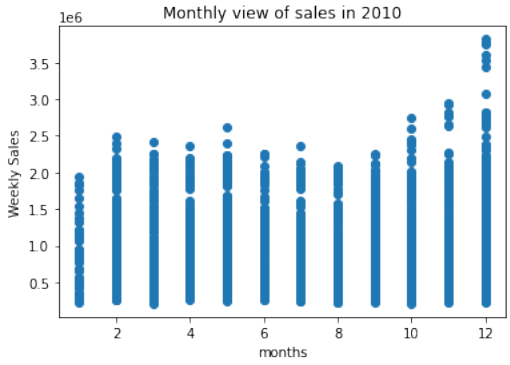


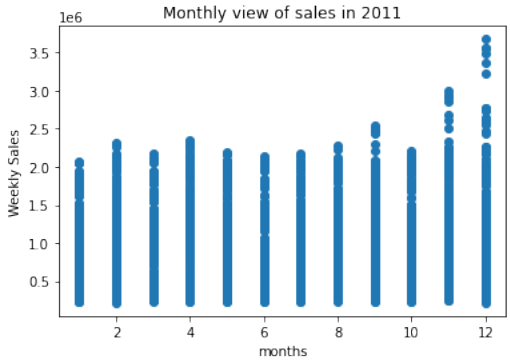


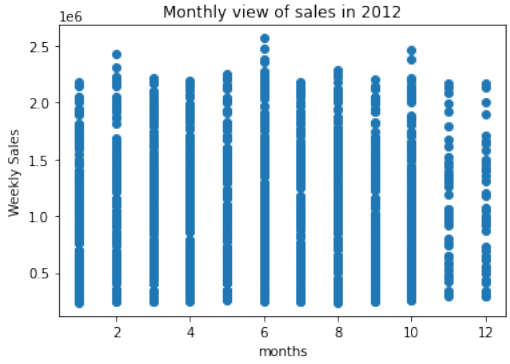
Q5: Provide a monthly and semester view of sales in units and give insights

In [16]:

```
# Monthly view of sales for each years
plt.scatter(data[data.Year==2010]["Month"],data[data.Year==2010]["Weekly_Sa
les"])
plt.xlabel("months")
plt.ylabel("Weekly Sales")
plt.title("Monthly view of sales in 2010")
plt.show()

plt.scatter(data[data.Year==2011]["Month"],data[data.Year==2011]["Weekly_Sa
les"])
plt.xlabel("months")
plt.ylabel("Weekly Sales")
plt.title("Monthly view of sales in 2011")
plt.show()

plt.scatter(data[data.Year==2012]["Month"],data[data.Year==2012]["Weekly_Sa
les"])
plt.xlabel("months")
plt.ylabel("Weekly Sales")
plt.title("Monthly view of sales in 2012")
plt.show()
```





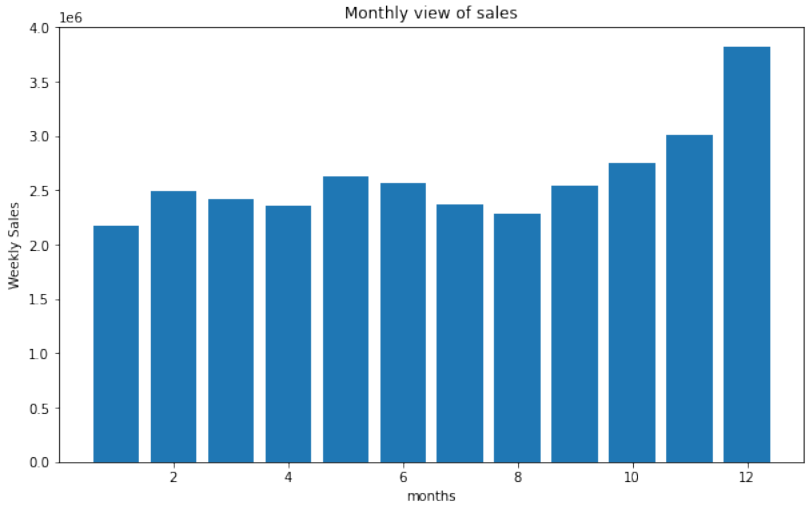


In [17]:

```
# Monthly view of sales for all years
plt.figure(figsize=(10,6))
plt.bar(data["Month"],data["Weekly_Sales"])
plt.xlabel("months")
plt.ylabel("Weekly Sales")
plt.title("Monthly view of sales")
```

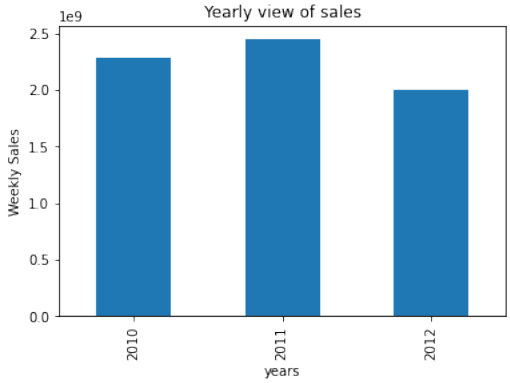
Out[17]:

```
Text(0.5, 1.0, 'Monthly view of sales')
```



In [18]:

```
# Yearly view of sales
plt.figure(figsize=(10,6))
data.groupby("Year")[["Weekly_Sales"]].sum().plot(kind='bar',legend=False)
plt.xlabel("years")
plt.ylabel("Weekly Sales")
plt.title("Yearly view of sales");
<Figure size 720x432 with 0 Axes>
```

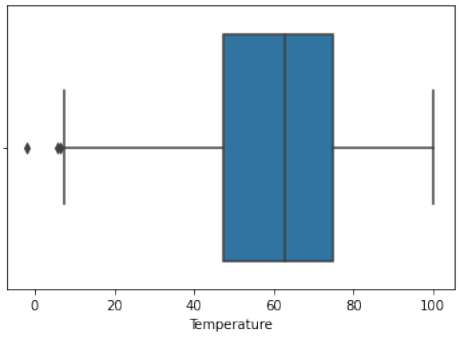


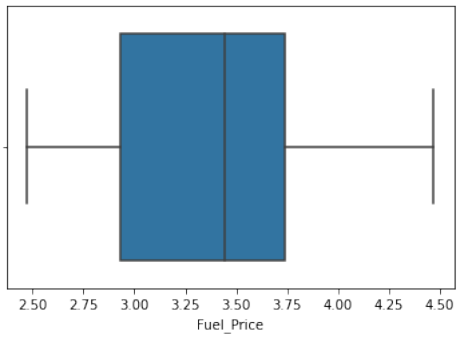
Build prediction models to forecast demand (Modeling)

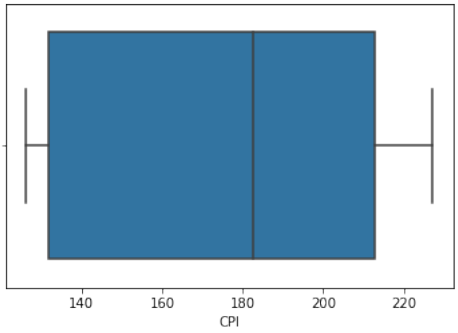
In [19]:

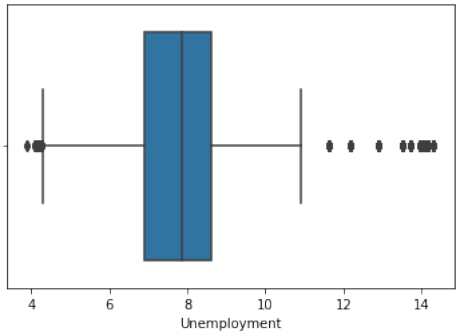
```
# find outliers
fig, axs = plt.subplots(4,figsize=(6,18))
X = data[['Temperature','Fuel_Price','CPI','Unemployment']]
for i,column in enumerate(X):
    sns.boxplot(data[column], ax=axs[i])
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
```

```
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
```









In [20]:

```
# drop the outliers
data_new = data[(data['Unemployment']<10) & (data['Unemployment']>4.5) &
(data['Temperature']>10)]
```

```
data_new
```

Out[20]:

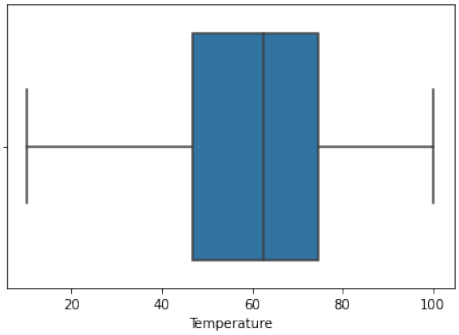
	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	Day	Month	Year
0	1	2010-05-02	1643690.90	0	42.31	2.572	211.096358	8.106	2	5	2010
1	1	2010-12-02	1641957.44	1	38.51	2.548	211.242170	8.106	2	12	2010
2	1	2010-02-19	1611968.17	0	39.93	2.514	211.289143	8.106	19	2	2010
3	1	2010-02-26	1409727.59	0	46.63	2.561	211.319643	8.106	26	2	2010
4	1	2010-05-03	1554806.68	0	46.50	2.625	211.350143	8.106	3	5	2010
...	...	...	...	...	...	...	...	...	...	...	...
6430	45	2012-09-28	713173.95	0	64.88	3.997	192.013558	8.684	28	9	2012
6431	45	2012-05-10	733455.07	0	64.89	3.985	192.170412	8.667	10	5	2012
6432	45	2012-12-10	734464.36	0	54.47	4.000	192.327265	8.667	10	12	2012
6433	45	2012-10-19	718125.53	0	56.47	3.969	192.330854	8.667	19	10	2012

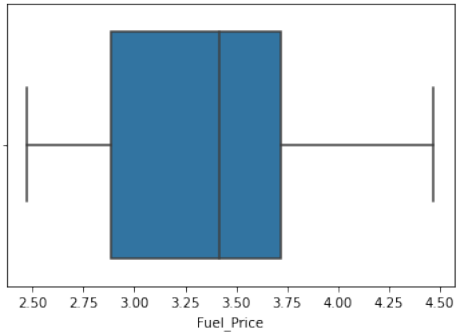
	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	Day	Month	Year
6434	45	2012-10-26	760281.43	0	58.85	3.882	192.308899	8.667	26	10	2012

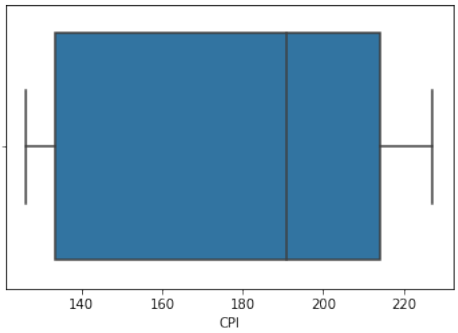
5658 rows × 11 columns

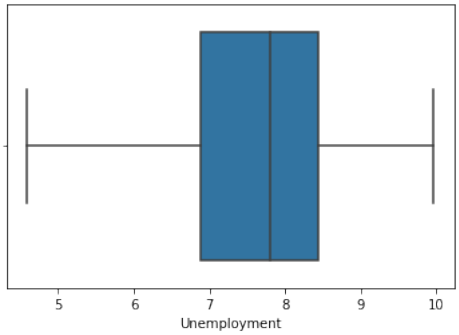
In [21]:

```
# check outliers
fig, axs = plt.subplots(4,figsize=(6,18))
X = data_new[['Temperature','Fuel_Price','CPI','Unemployment']]
for i,column in enumerate(X):
    sns.boxplot(data_new[column], ax=axs[i])
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variable as a keyword arg: x. From ve
rsion 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or misi
nterpretation.
  warnings.warn(
```









Build Model

In [22]:

```
# Import sklearn
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.linear_model import LinearRegression
```

Preparing the data for building the model

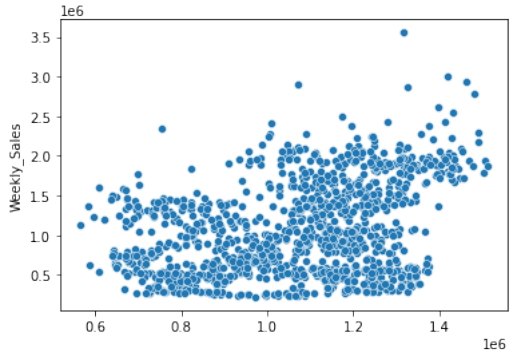
In [23]:

```
# Select features and target
X =
data_new[['Store','Fuel_Price','CPI','Unemployment','Day','Month','Year']]
y = data_new['Weekly_Sales']

# Split data to train and test (0.80:0.20)
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2)
```

Linear Regression Model

In [24]:

```
print('Linear Regression:')
print()
reg = LinearRegression()
reg.fit(X_train, y_train)
y_pred = reg.predict(X_test)
print('Accuracy:',reg.score(X_train, y_train)*100)


print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pred))
print('Root Mean Squared Error:',
np.sqrt(metrics.mean_squared_error(y_test, y_pred)))


sns.scatterplot(y_pred, y_test);
Linear Regression:

Accuracy: 13.169898496187448
Mean Absolute Error: 448305.96882679034
Mean Squared Error: 285848168537.0719
Root Mean Squared Error: 534647.7050704247
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variables as keyword args: x, y. From
version 0.12, the only valid positional argument will be `data`, and passin
g other arguments without an explicit keyword will result in an error or mi
sinterpretation.
  warnings.warn(
```

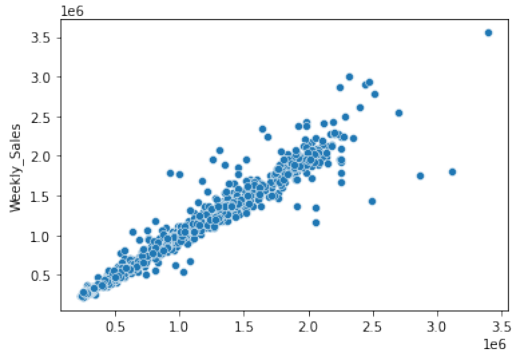


Random Forest Model

In [25]:

```
print('Random Forest Regressor:')
print()
rfr = RandomForestRegressor(n_estimators = 400,max_depth=15,n_jobs=5)
```

```
rfr.fit(X_train,y_train)
y_pred=rfr.predict(X_test)
print('Accuracy:',rfr.score(X_test, y_test)*100)

print('Mean Absolute Error:', metrics.mean_absolute_error(y_test, y_pred))
print('Mean Squared Error:', metrics.mean_squared_error(y_test, y_pred))
print('Root Mean Squared Error:',
np.sqrt(metrics.mean_squared_error(y_test, y_pred)))


sns.scatterplot(y_pred, y_test);
Random Forest Regressor:

Accuracy: 94.64757884924798
Mean Absolute Error: 66761.21052046979
Mean Squared Error: 17326927375.45104
Root Mean Squared Error: 131631.7871011825
/Applications/anaconda3/lib/python3.8/site-packages/seaborn/_decorators.py:
36: FutureWarning: Pass the following variables as keyword args: x, y. From
version 0.12, the only valid positional argument will be `data`, and passin
g other arguments without an explicit keyword will result in an error or mi
sinterpretation.
  warnings.warn(
```



Random Forest Regressor gives us a very good accuracy of 96% as shown in the scatter plot.