

# Colorado Vehicle Sales Analysis Report

Project 3

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Vehicle Analysis

# 1 Data Exploration

	year	quarter	county	sales
0	2008	1	Adams	231609000
1	2008	1	Arapahoe	550378000
2	2008	1	Boulder/Broomfield	176771000
3	2008	1	Denver	200103000
4	2008	1	Douglas	93259000

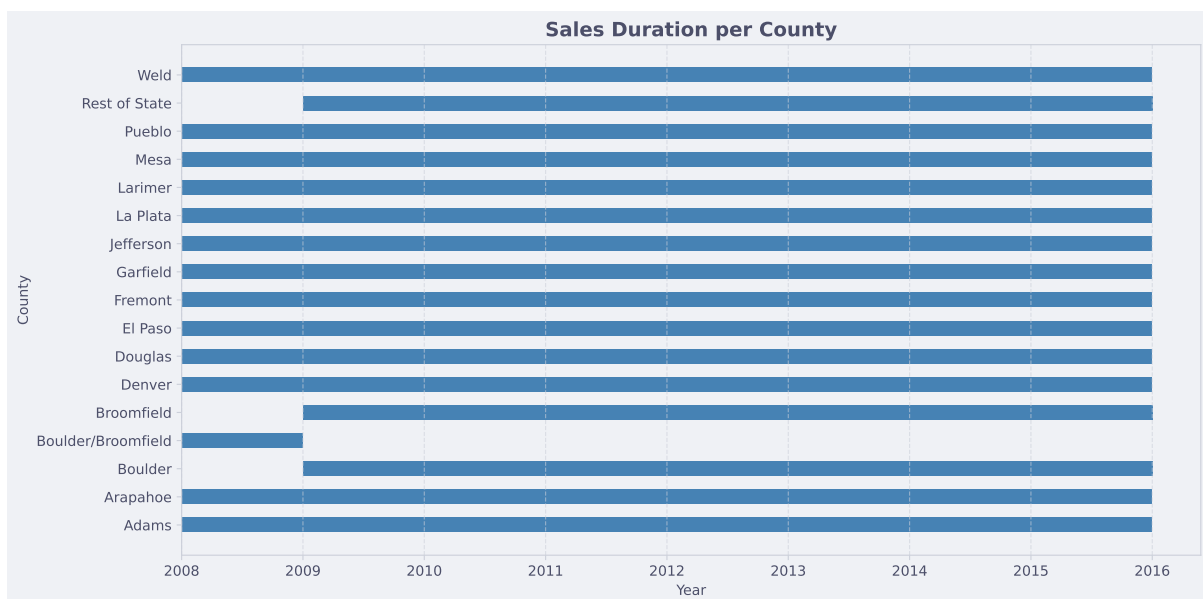
(501, 4)

## 1.1 Sales Summary

=== Sales Summary (in Million USD) ===

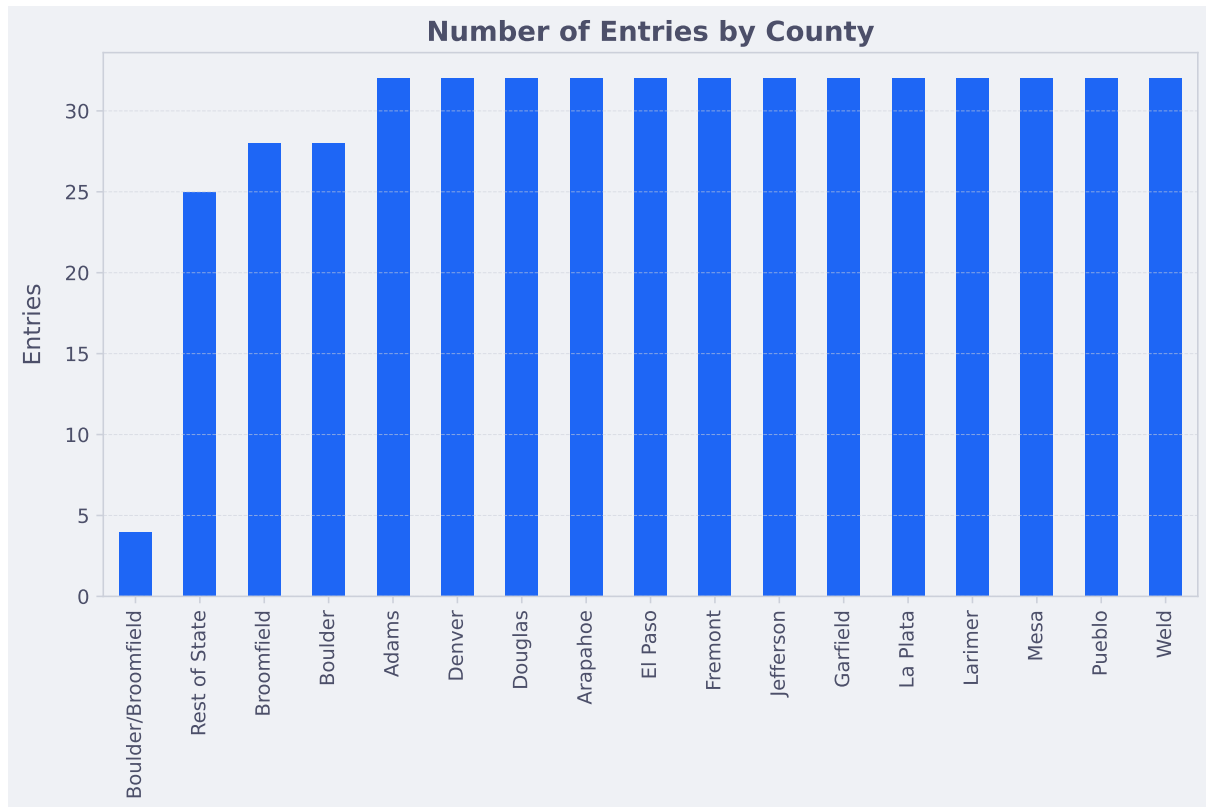
Count : 501  
Mean : 176.06 M USD  
Standard Dev : 164.21 M USD  
Min : 6.27 M USD  
25th Percentile: 61.48 M USD  
Median : 138.58 M USD  
75th Percentile: 224.16 M USD  
IQR : 162.68 M USD  
Max : 916.91 M USD  
Skewness : 1.78  
Kurtosis : 3.68

## 2 Sales Duration per County

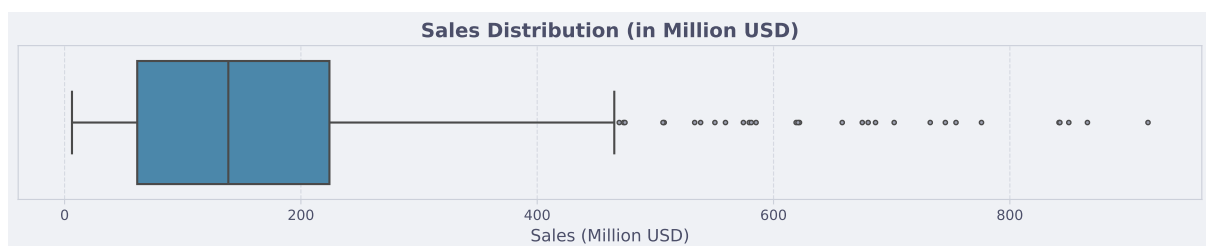


Note: The graph illustrates a change in data categorization. Boulder and Broomfield data were combined as “Boulder/Broomfield” in 2008, then reported as separate entities from 2009 onwards.

### 3 Number of Entries by County

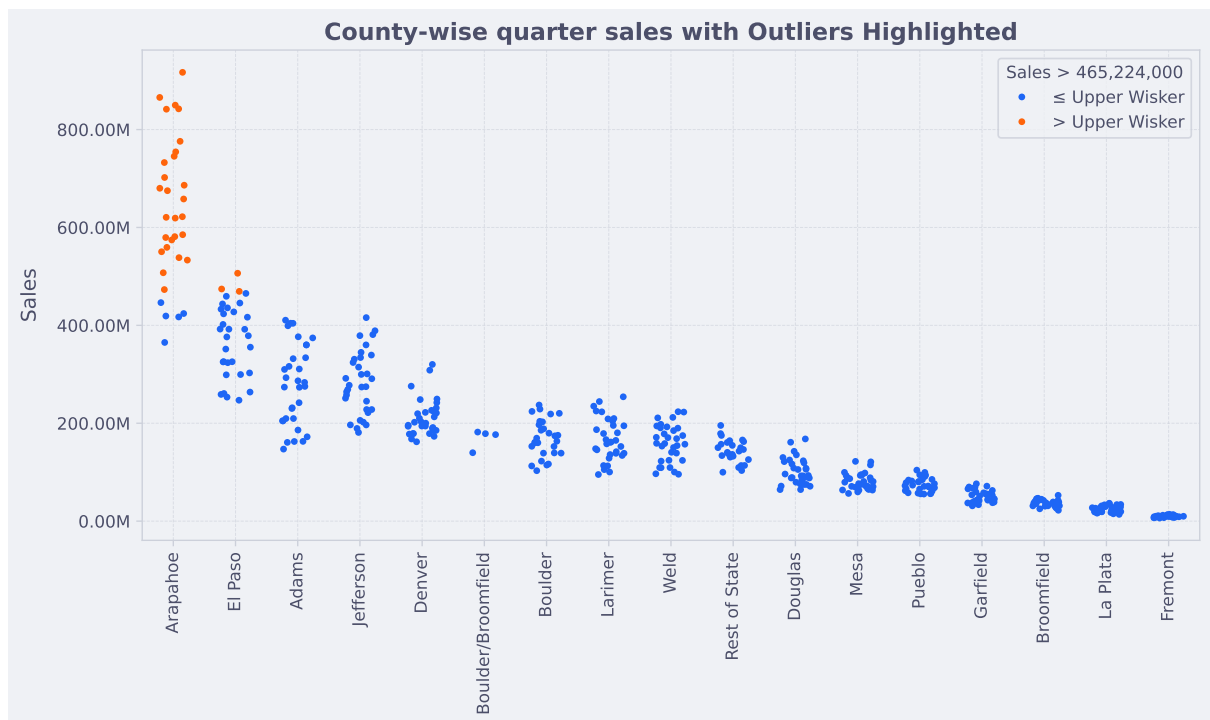


### 4 Box plot of Sales Data



Beyond the end of the right whisker, these are outliers, representing sales figures that are significantly higher than the vast majority of the other sales data

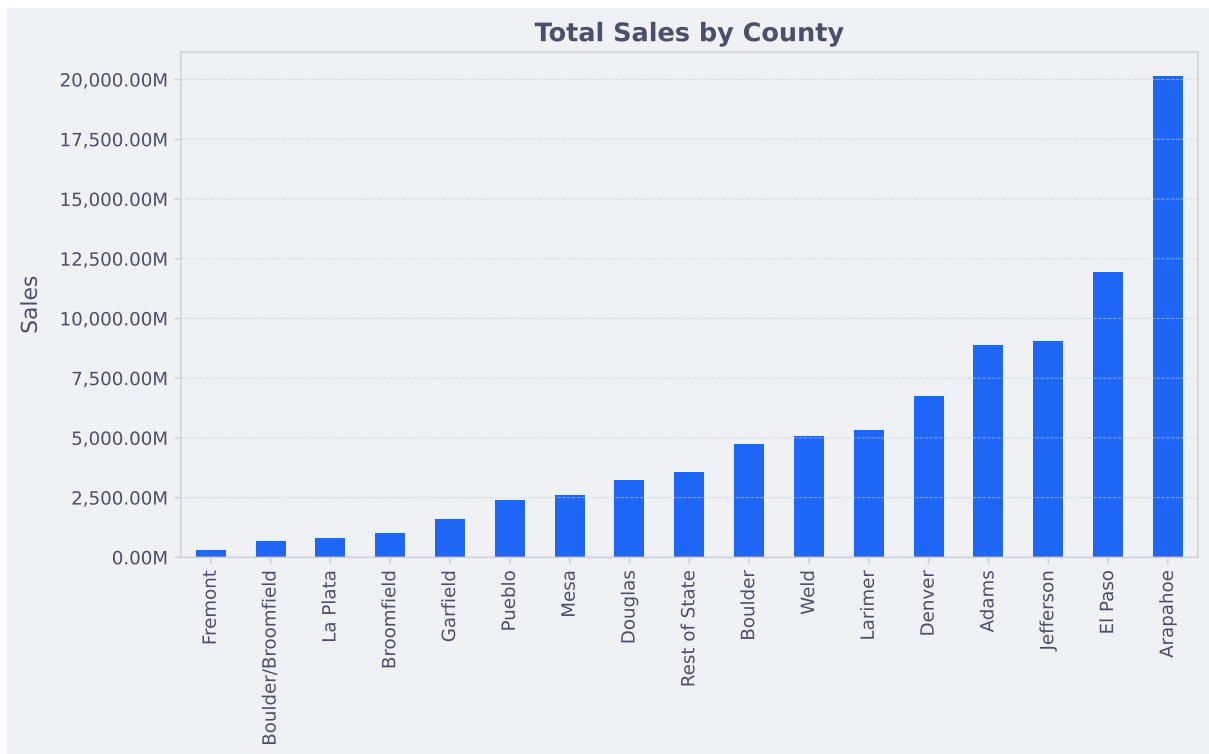
## 5 County-wise Quarter Sales



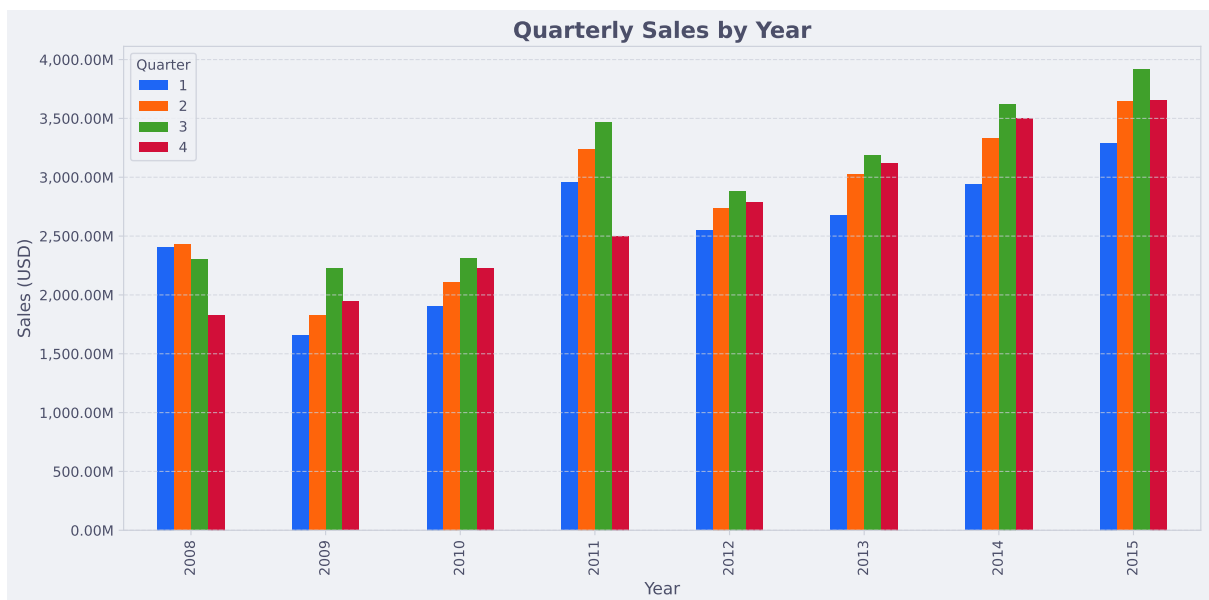
## 6 Number of outlier by each county

```
county
Arapahoe      27
El Paso       3
dtype: int64
```

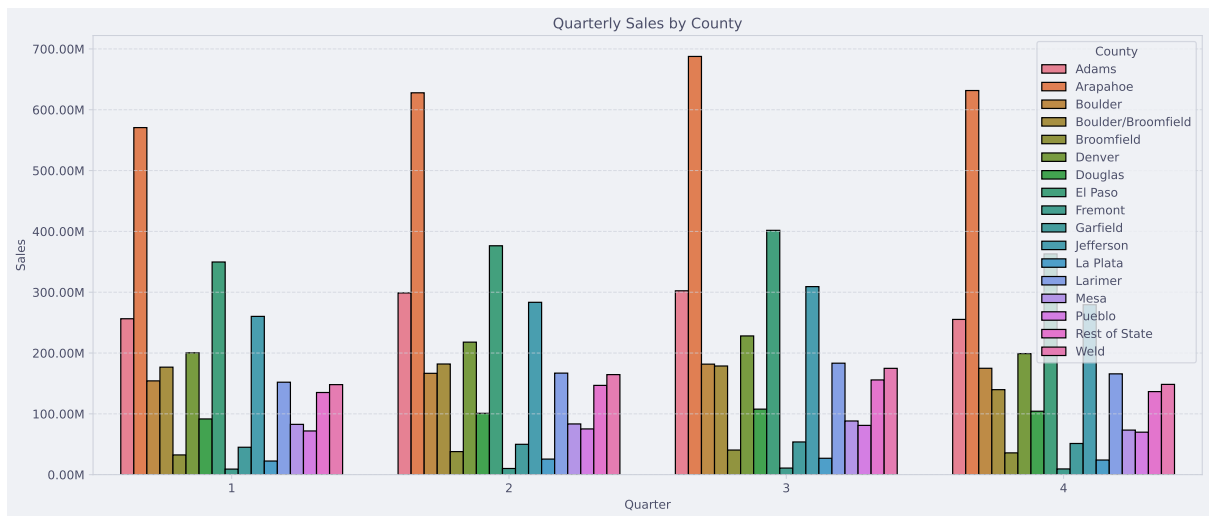
## 7 Total Sales by County



## 8 Quarterly Sales by Year



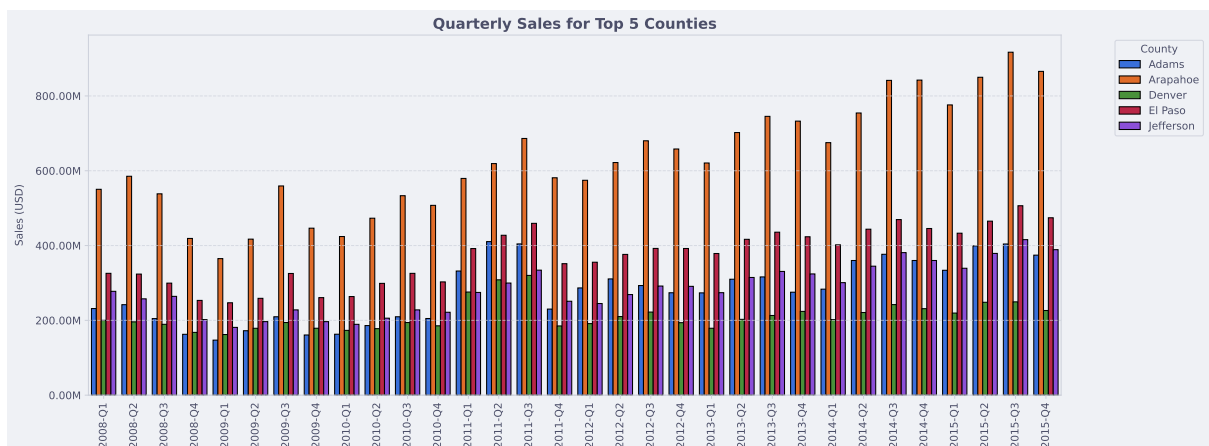
## 9 Quarterly Sales by County



## 10 Yearly Sales by County



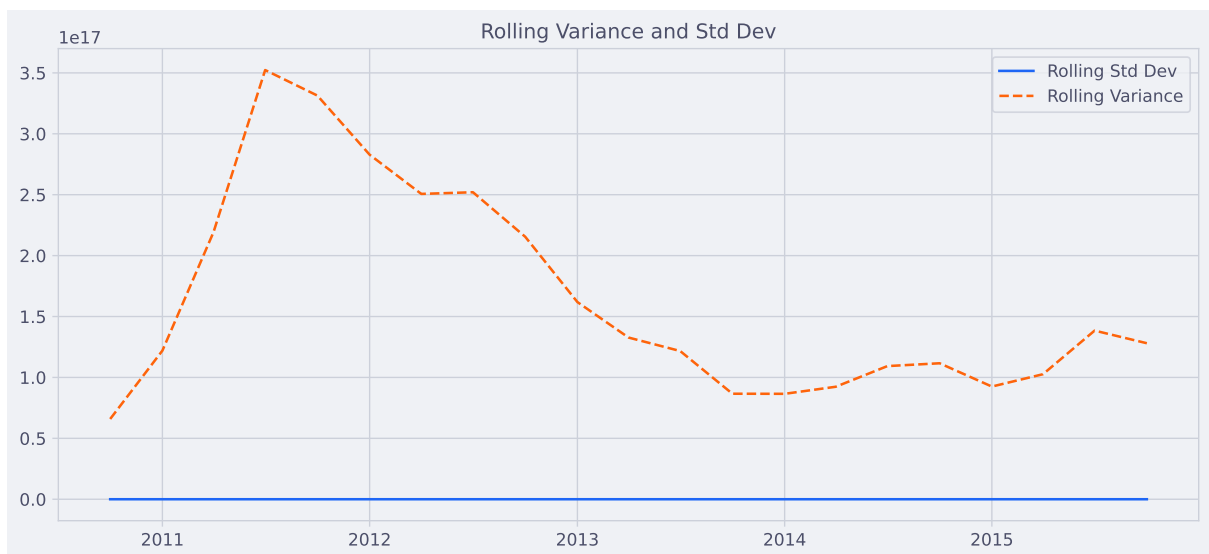
## 11 Quarterly Sales for Top 5 Counties



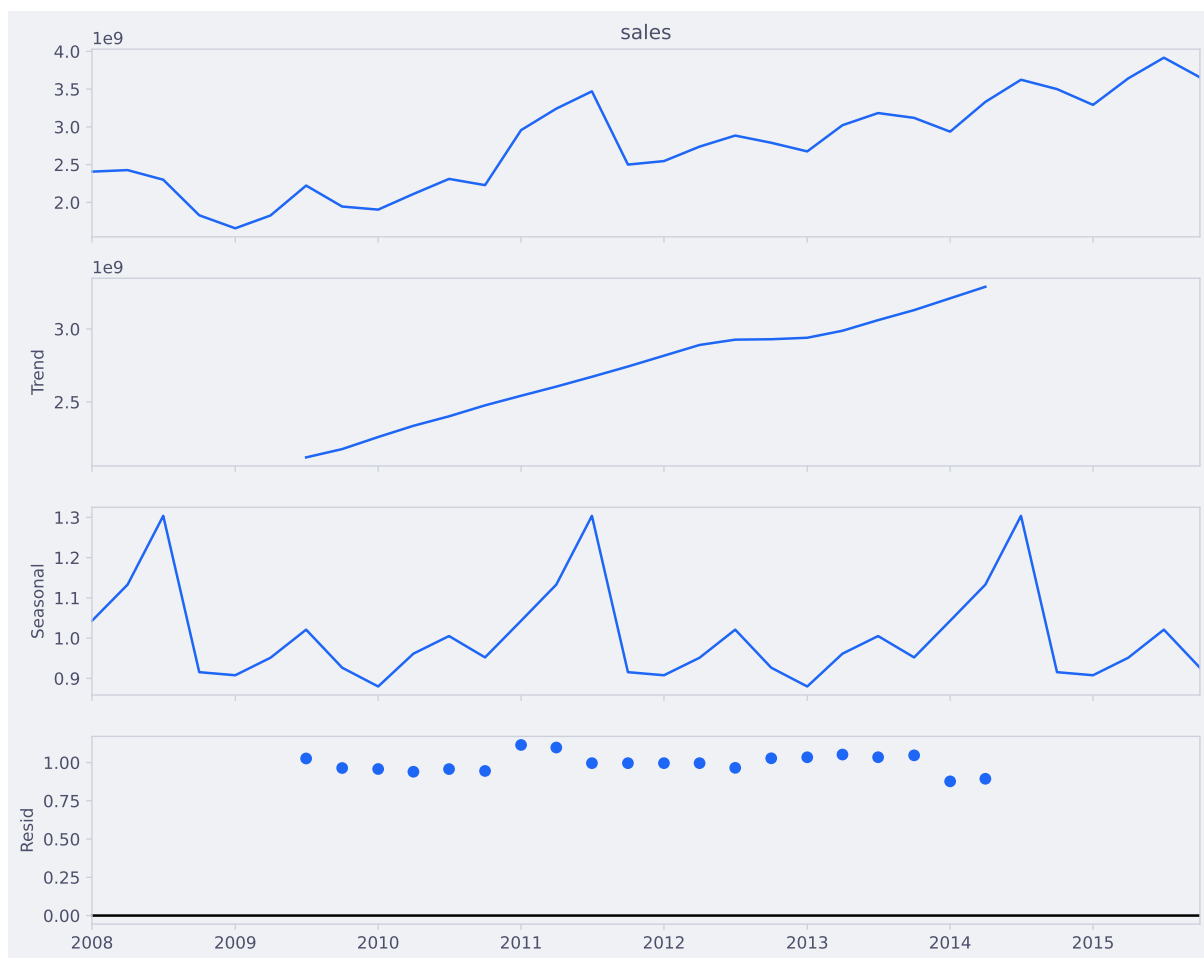
## 12 Quarterly Sales Trend



## 13 Variance and Standard Deviation Over Time



## 14 Seasonal Decomposition



## 15 ML Model

Train shape: (25,)

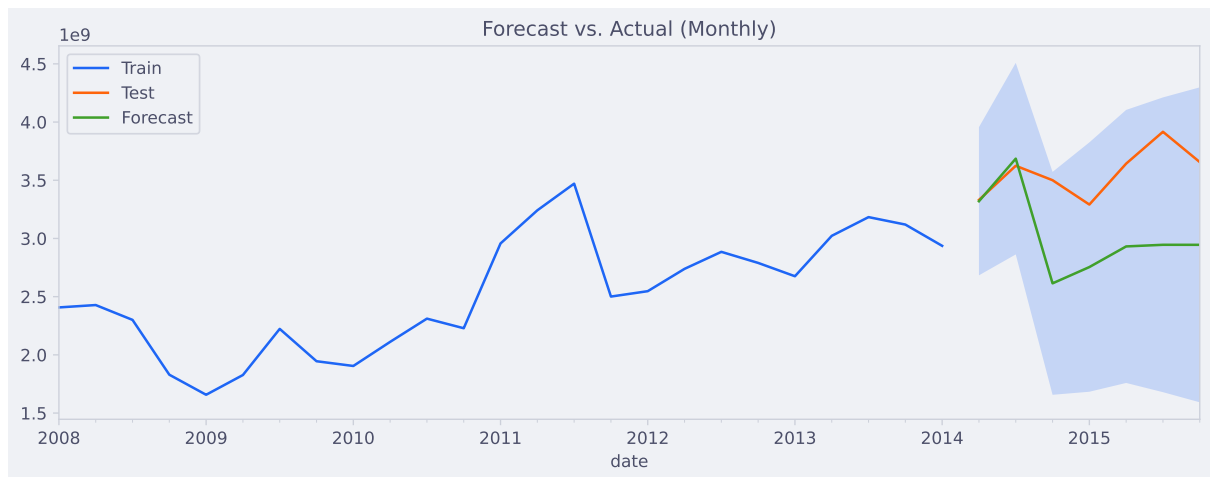
Test shape: (7,)

Model Summary

	coef	std err	z	P> z	[0.025	0.975]
ar.L1	0.2803	0.967	0.290	0.772	-1.615	2.176
ma.L1	-0.4609	0.827	-0.557	0.577	-2.082	1.160
ar.S.L12	-0.1159	3.134	-0.037	0.970	-6.258	6.026
ma.S.L12	0.4511	3.003	0.150	0.881	-5.435	6.337
sigma2	1.05e+17	nan	nan	nan	nan	nan

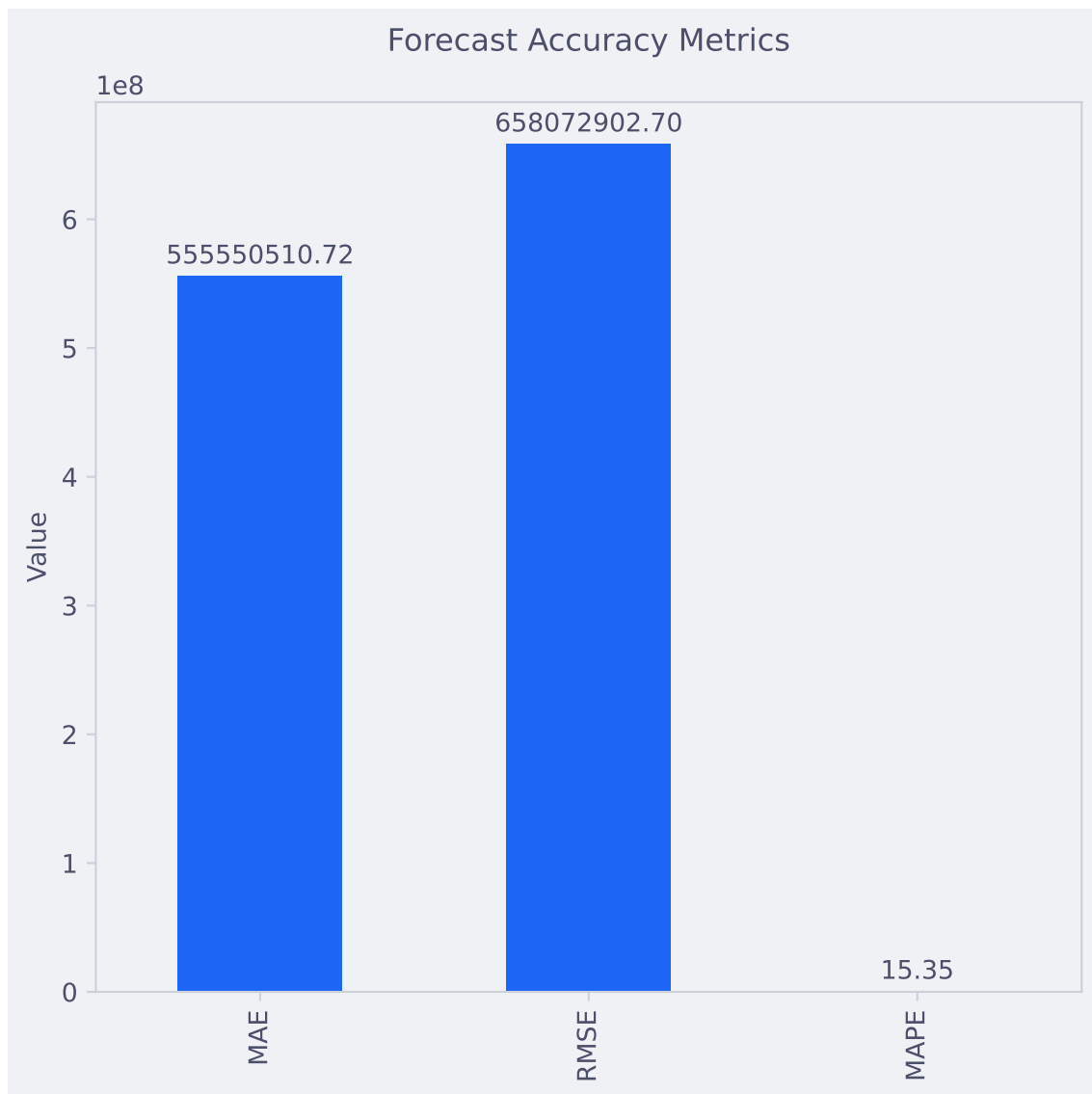


## 16 Forecast vs Actual

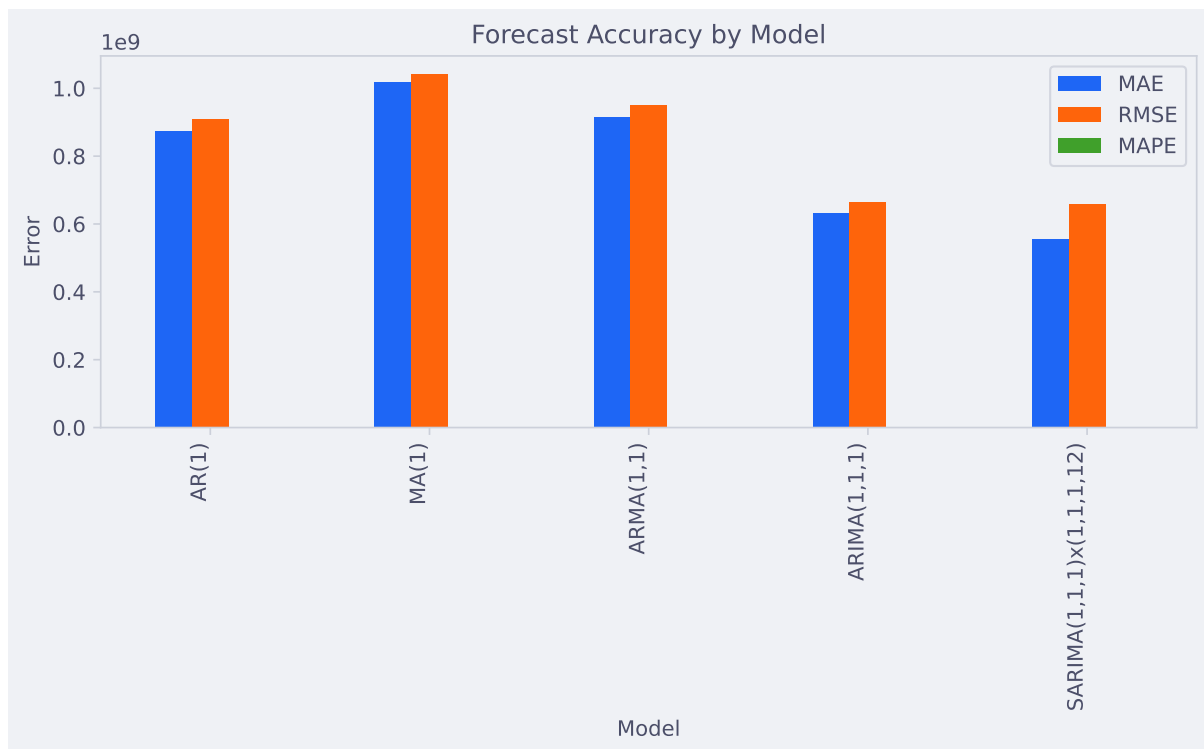


## 17 Forecast Accuracy Metrics

	MAE	RMSE	MAPE
0	5.555505e+08	6.580729e+08	15.346031



## 18 Forecast Accuracy by Model



Model	MAE	RMSE	MAPE
AR(1)	8.730147e+08	9.096694e+08	24.173899
MA(1)	1.019478e+09	1.043220e+09	28.336291
ARMA(1,1)	9.161603e+08	9.508537e+08	25.389576
ARIMA(1,1,1)	6.334686e+08	6.637395e+08	17.510653
SARIMA(1,1,1)x(1,1,1,12)	5.555505e+08	6.580729e+08	15.346031