RETAIL GIANT SALES FORECASTING

BACKGROUND

Business problem

- Global mart is an online supergiant store that has worldwide operations. This store takes orders and delivers across the globe and deals with all the major product categories — consumer, corporate and home office.
- **Objectives**:
  - To find the most profitable market segment
  - To forecast the sales of the products for the next 6 months, so that you have a proper estimate and can plan your inventory and business processes accordingly.

ANALYSIS DIVISIONS

- DATA UNDERSTANDING
- FINDING THE MOST PROFITABLE MARKET SEGMENT
- FORECASTING THE SALES USING VARIOUS TIME SERIES METHODS
- RECOMMENDING THE BETTER METHOD FOR PREDICTING THE SALES

DATA UNDERSTANDING

- The store data has 5 attributes and the description is given right side.
- The store caters to 7 different geographical market segments and 3 major customer segments, i.e. Consumer, corporate and home.

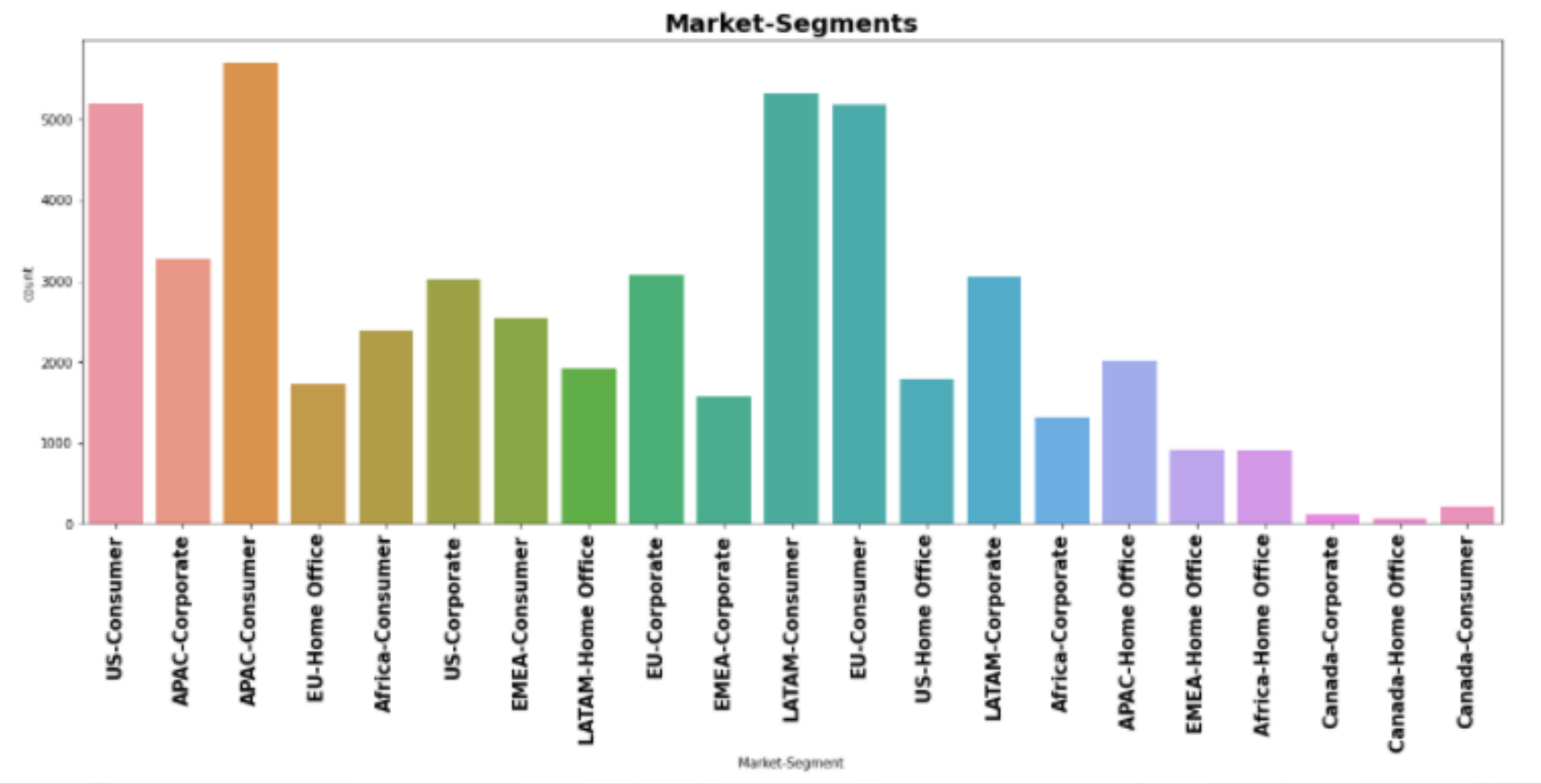
Attributes	Description
Order-Date	The date on which the order was placed
Segment	The segment to which the product belongs
Market	The market to which the customer belongs
Sales	Total sales value of the transaction
Profit	Profit made on the transaction

Market	Segment
Africa	Consumer
APAC (Asia Pacific)	Corporate
Canada	Home Office
EMEA(Middle East)	
EU (European Union)	
LATAM (Latin America)	
US (United States)	

UNIQUE MARKET SEGMENTS

- THERE ARE 21 UNIQUE MARKET SEGMENTS

1	APAC-Consumer
2	LATAM-Consumer
3	US-Consumer
4	EU-Consumer
5	APAC-Corporate
6	EU-Corporate
7	LATAM-Corporate
8	US-Corporate
9	EMEA-Consumer
10	Africa-Consumer
11	APAC-Home
12	LATAM-Home
13	US-Home
14	EU-Home
15	EMEA-Corporate
16	Africa-Corporate
17	EMEA-Home
18	Africa-Home
19	Canada-Consumer
20	Canada-Corporate
21	Canada-Home


Market-Segments
Count
5000
4000
3000
2000
1000
0
US-Consumer
APAC-Corporate
APAC-Consumer
EU-Home Office
Africa-Consumer
US-Corporate
EMEA-Consumer
LATAM-Home Office
EU-Corporate
EMEA-Corporate
LATAM-Consumer
EU-Consumer
US-Home Office
LATAM-Corporate
Africa-Corporate
APAC-Home Office
EMEA-Home Office
Africa-Home Office
Canada-Corporate
Canada-Home Office
Canada-Consumer
Market-Segment

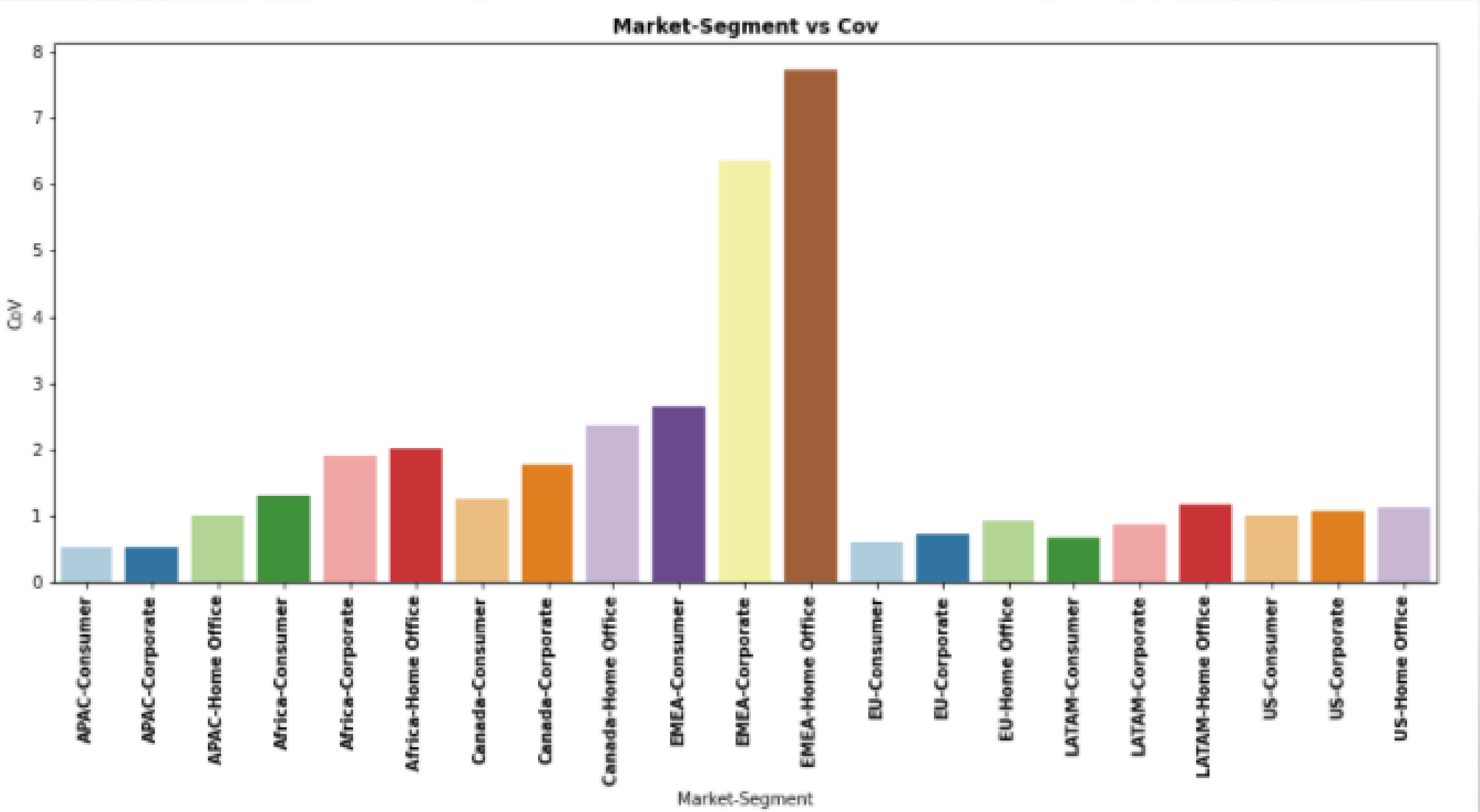
FINDING THE MOST PROFITABLE MARKET SEGMENT

- The coefficient of variation (cov) is used to find the most profitable market segment.
- Represents the ratio between the standard deviation and the mean
- It is useful statistics for comparing the degree of variation from one data series to another, even if the means are drastically different from one another.
- Higher the CoV value, higher is the fluctuations. Lower value, has lower fluctuation.

COEFFICIENT OF VARIATIONS OF EACH MARKET SEGMENT

S.No.	Market-Segment	CoV
1	***APAC-Consumer***	***0.522725***
2	APAC-Corporate	0.530051
3	EU-Consumer	0.595215
4	LATAM-Consumer	0.68377
5	EU-Corporate	0.722076
6	LATAM-Corporate	0.882177
7	EU-Home Office	0.938072
8	APAC-Home Office	1.008219
9	US-Consumer	1.01053
10	US-Corporate	1.071829
11	US-Home Office	1.12403

S.No.	Market-Segment	CoV
12	LATAM-Home Office	1.169693
13	Canada-Consumer	1.250315
14	Africa-Consumer	1.310351
15	Canada-Corporate	1.786025
16	Africa-Corporate	1.891744
17	Africa-Home Office	2.012937
18	Canada-Home Office	2.369695
19	EMEA-Consumer	2.652495
20	EMEA-Corporate	6.355024
21	EMEA-Home Office	7.732073

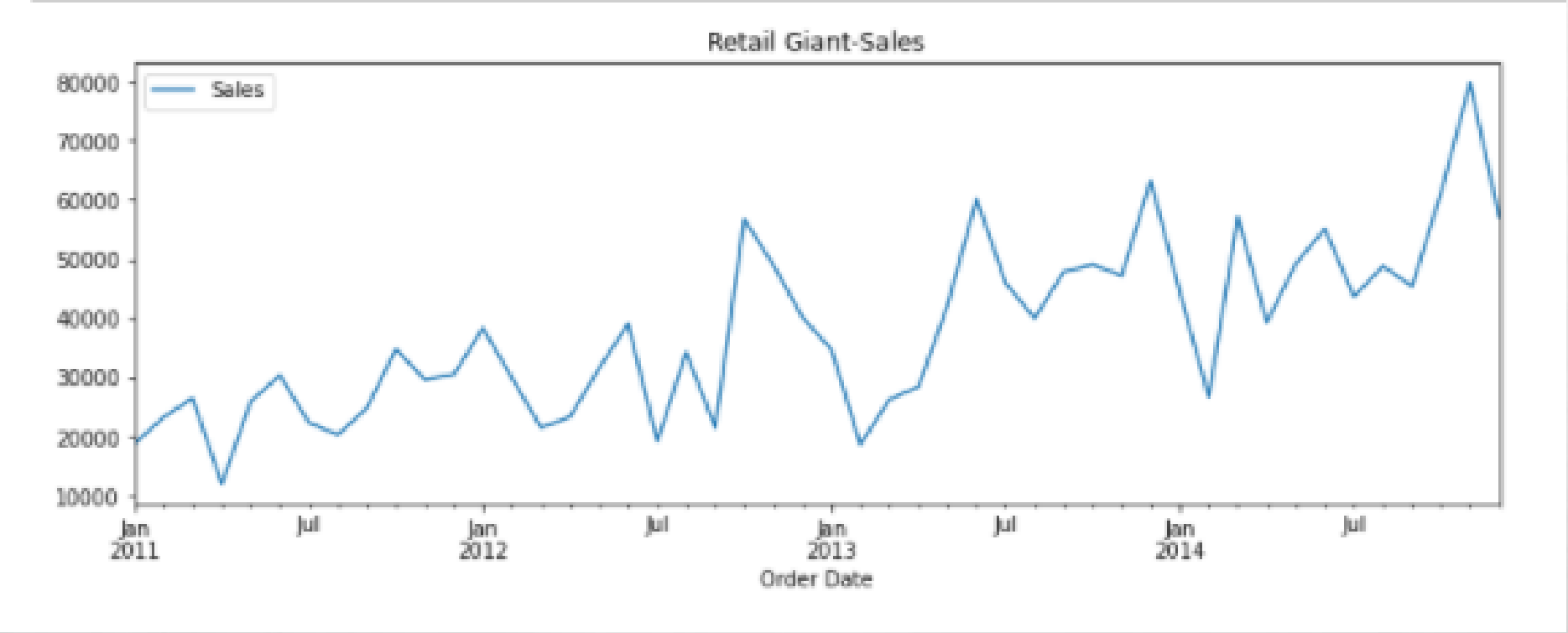


- Clearly APAC-Consumer has the lowest CoV and is the profitable market segment

- ***APAC-consumer with lowest CoV of 0.522725 is the most profitable segment***

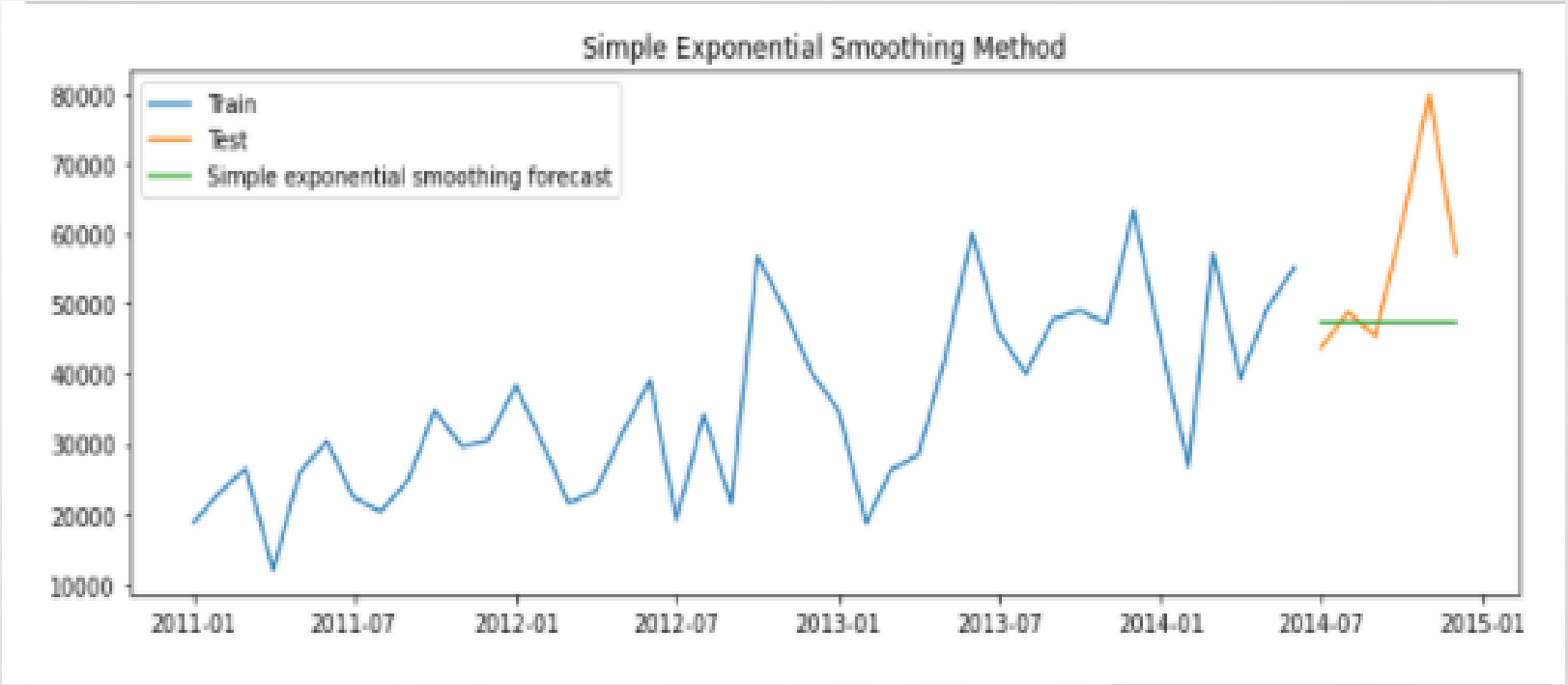
S.No.	Market-Segment	CoV
1	*APAC-Consumer*	*0.522725*

TIME SERIES - SALES



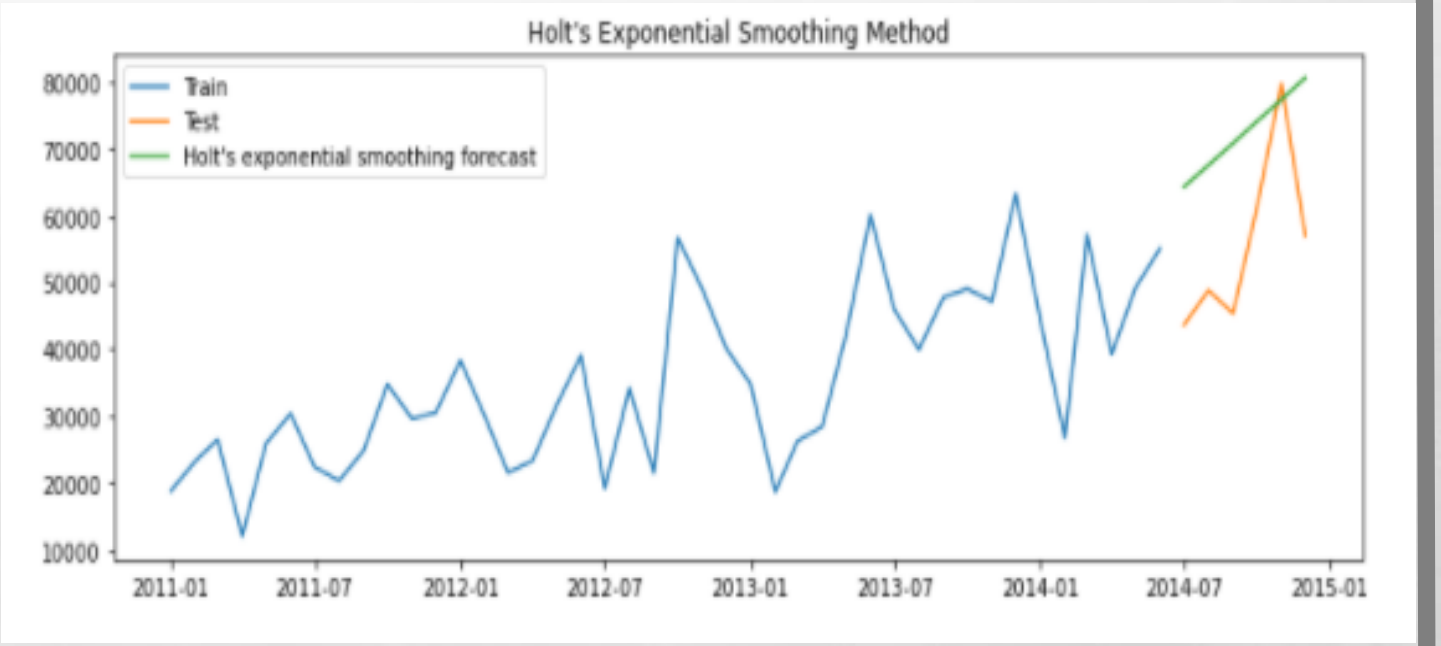
SIMPLE EXPONENTIAL SMOOTHING

IT DOES NOT CAPTURE THE TREND AND SEASONALITY .



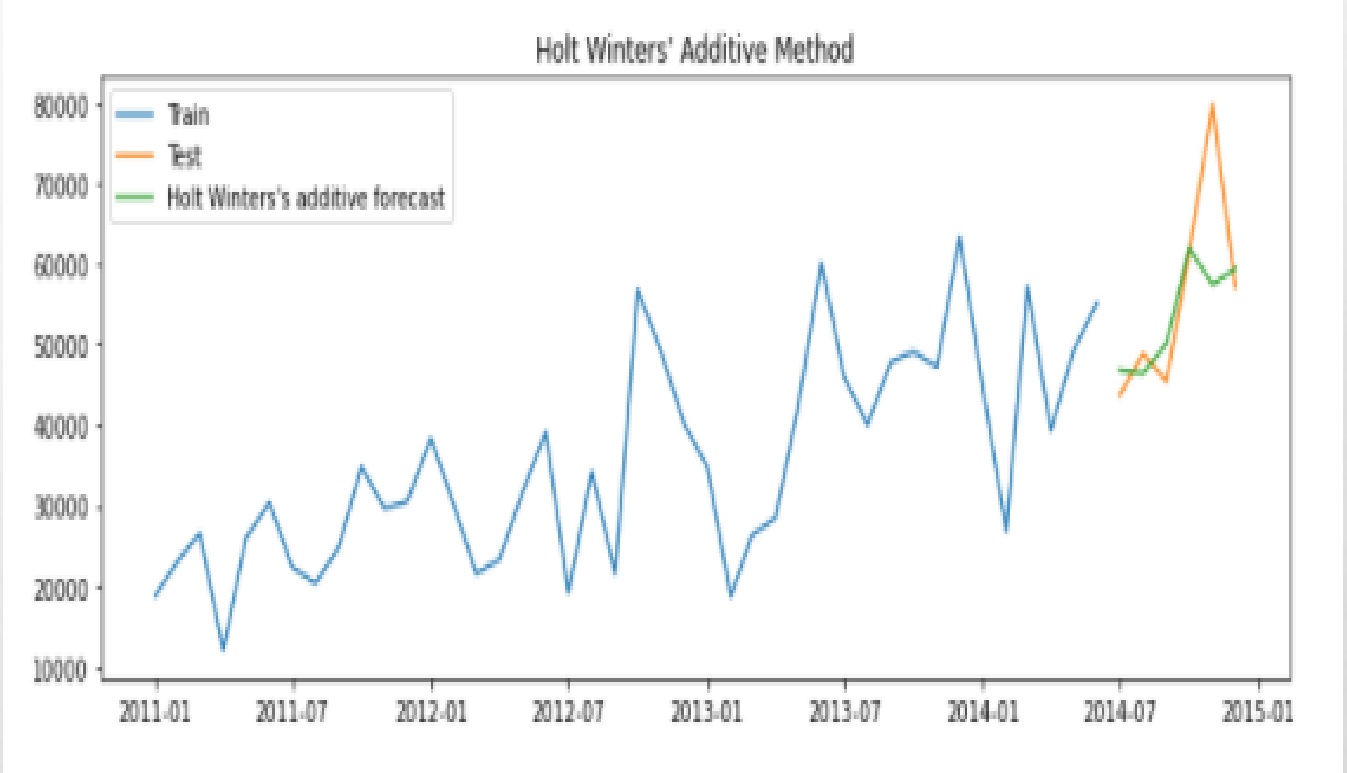
HOLT'S EXPONENTIAL SMOOTHING

IT CAPTURES THE TREND BUT DOES NOT CAPTURE THE SEASONALITY.



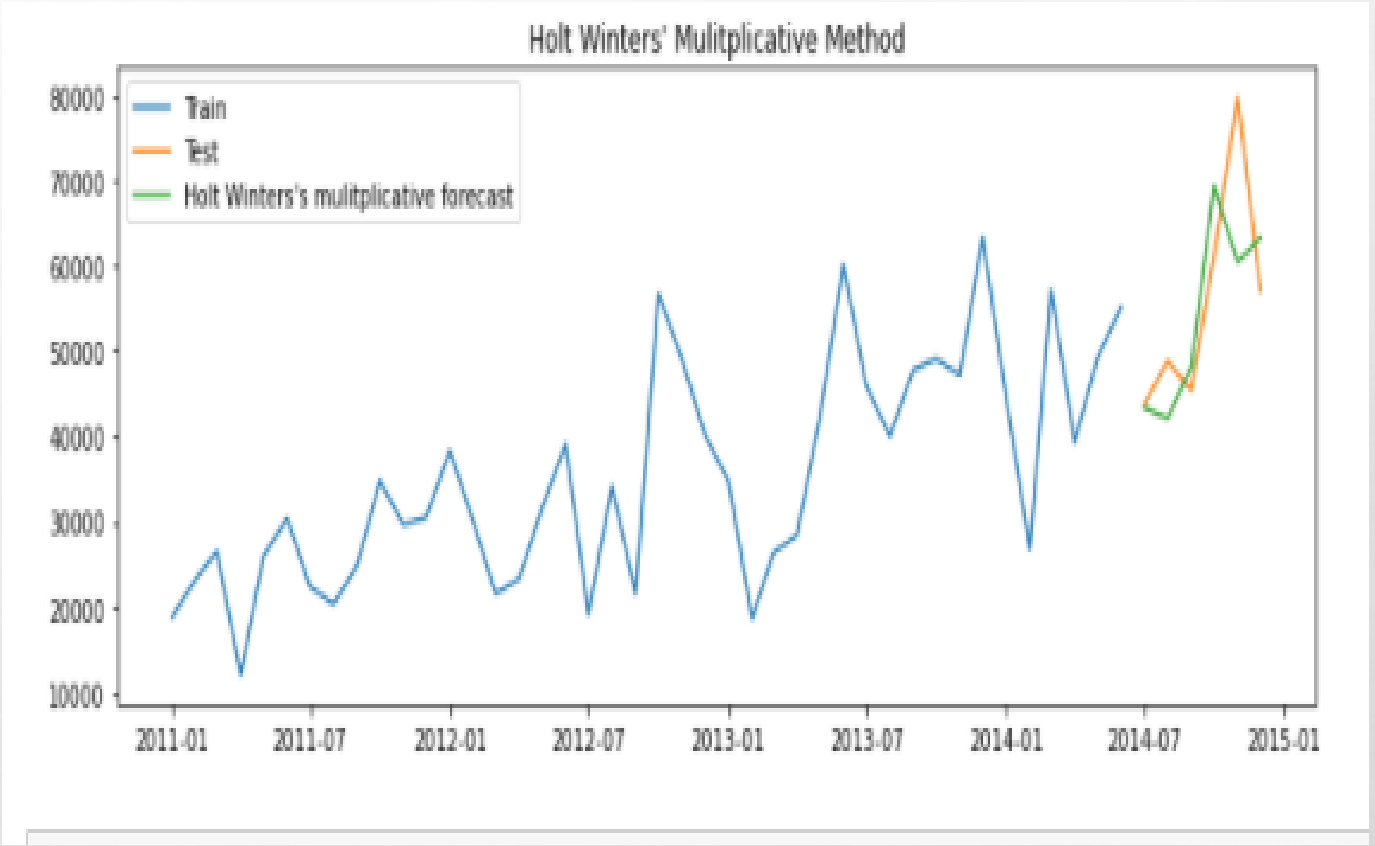
HOLT WINTERS' ADDITIVE METHOD WITH TREND AND SEASONALITY

IT CAPTURES BOTH SEASONALITY AND TREND AND ALMOST PREDICTS SAME AS THE ACTUAL.



HOLT WINTER'S MULTIPLICATIVE METHOD WITH TREND AND SEASONALITY

SIMILAR TO THE PREVIOUS ADDITIVE METHOD THIS ALSO CAPTURES BOTH SEASONALITY AND TREND.



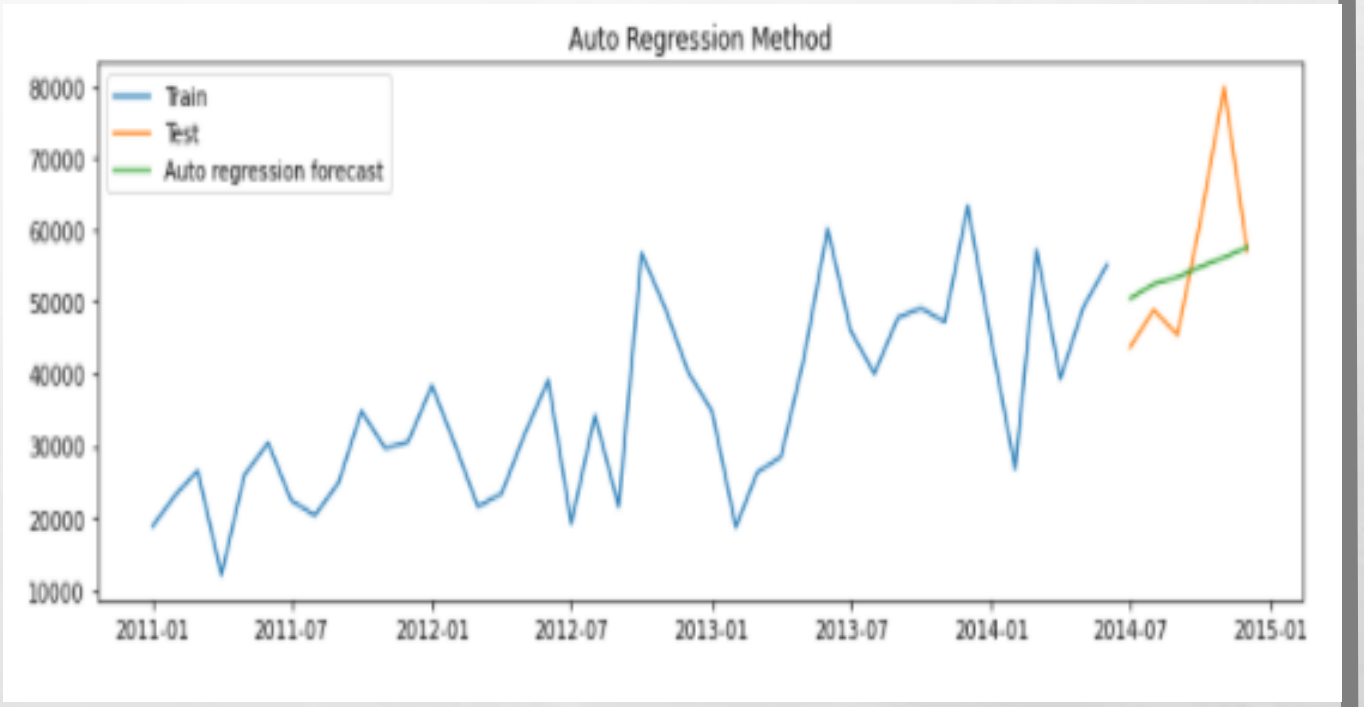
RMSE AND MAPE

FROM THE SMOOTHING TECHNIQUES THE HOLT WINTER'S ADDITIVE METHOD GIVES THE BETTER FORCAST FOR THE 6 MONTHS

	Method	RMSE	MAPE
0	Naive method	12355.97	17.47
0	Simple average method	24146.06	34.34
0	Simple moving average forecast	14756.73	15.82
0	Simple exponential smoothing forecast	15011.49	15.99
0	Holt's exponential smoothing method	18978.37	34.57
0	Holt Winters' additive method	9555.61	9.33
0	Holt Winters' multiplicative method	9423.23	11.43

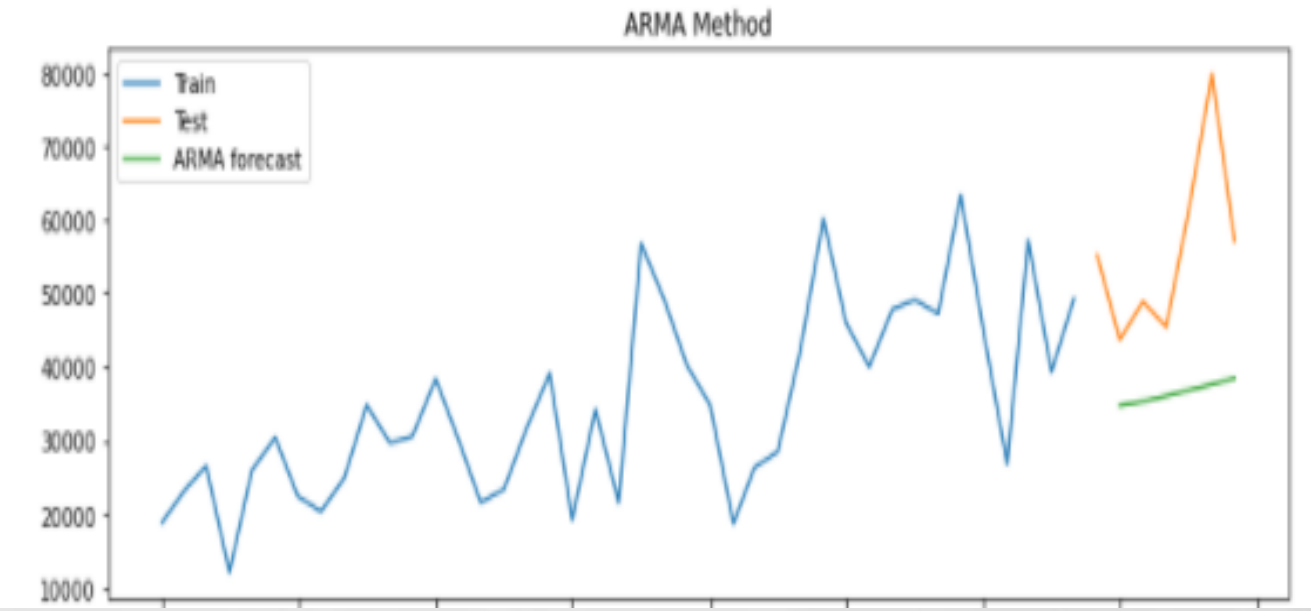
AUTO REGRESSION METHOD

THIS METHOD CAPTURES THE TREND BUT DOES NOT HAVE THE SEASONALITY.



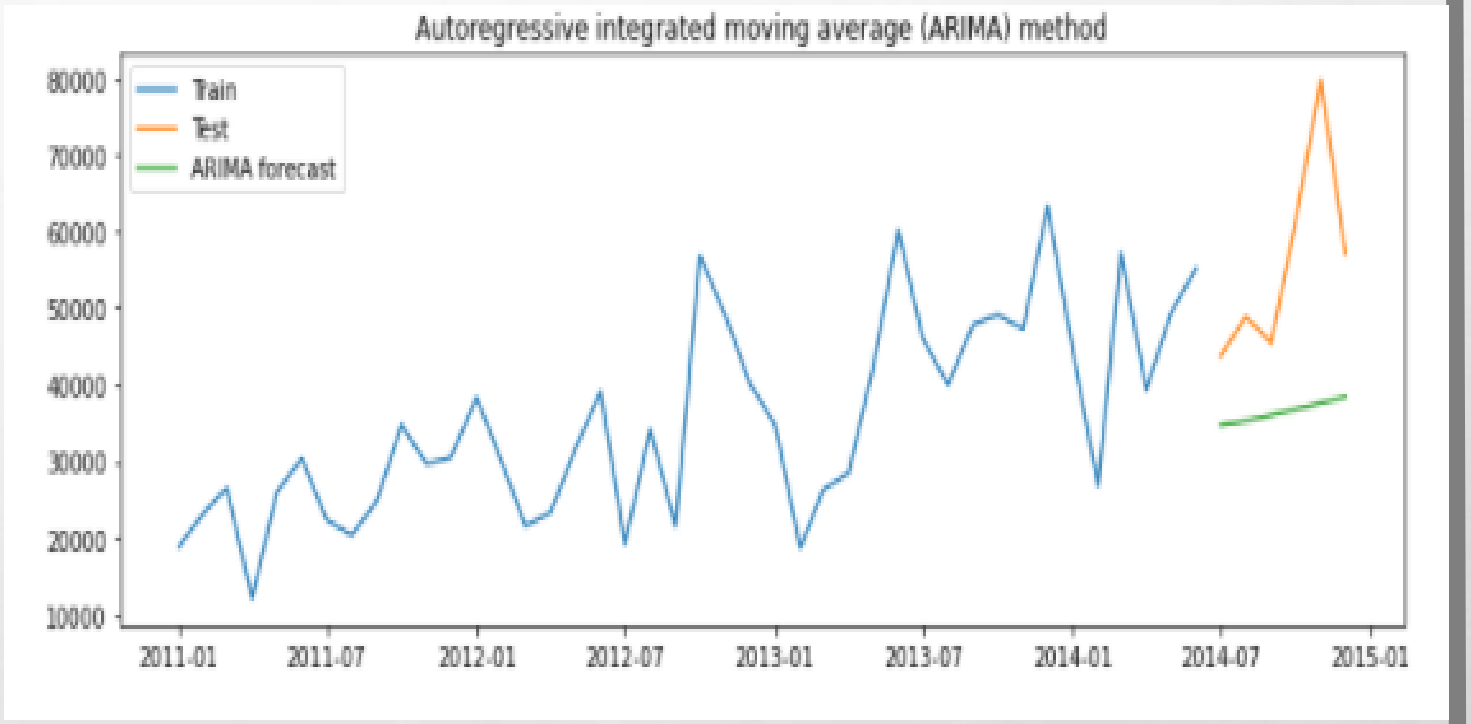
ARMA METHOD

ARMA METHOD CAPTURES THE TREND BUT DOES NOT HAVE THE SEASONALITY COMPONENT IN IT.



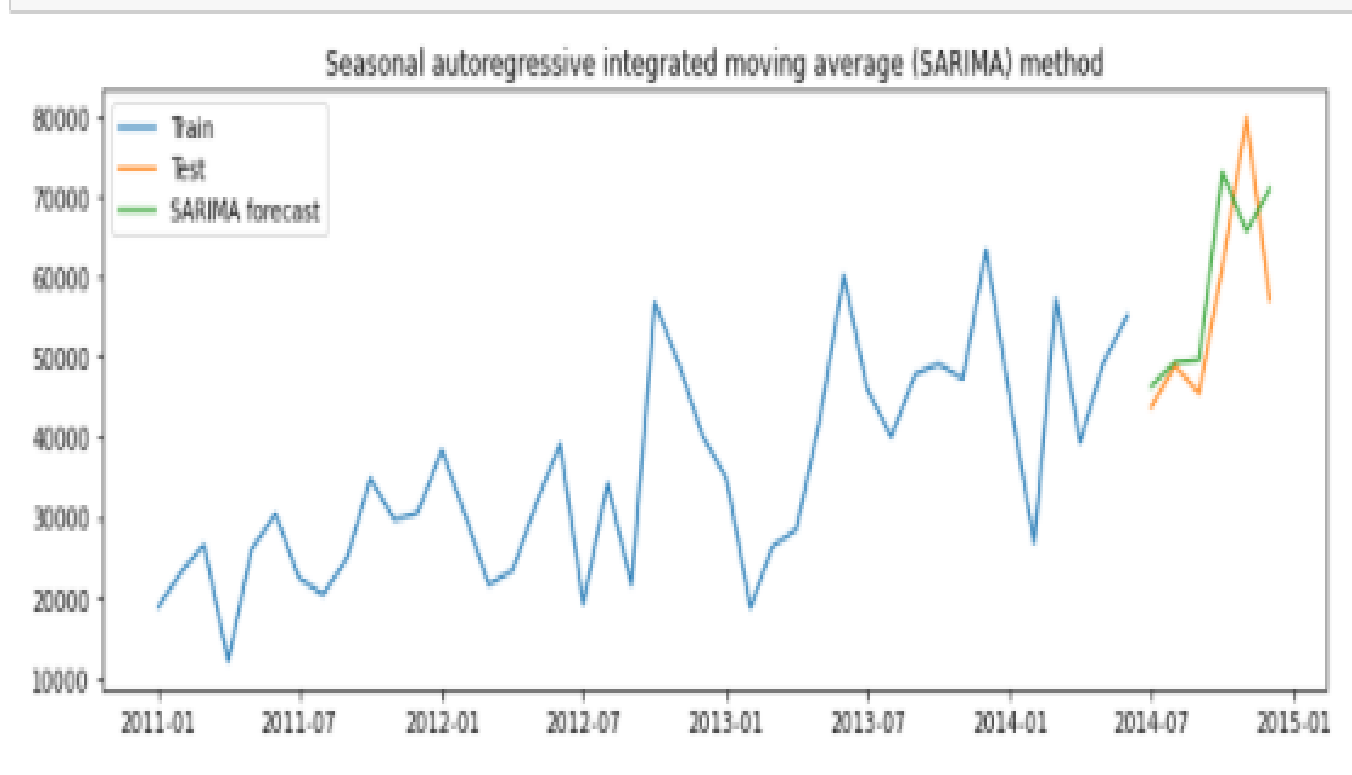
ARIMA METHOD

SIMILAR TO ARMA ARIMA ALSO DOES NOT CAPTURE THE SEASONAL COMPONENT AND HENCE THIS METHOD IS ALSO NOT EFFICIENT FOR THE CURRENT ANALYSIS.



SARIMA METHOD

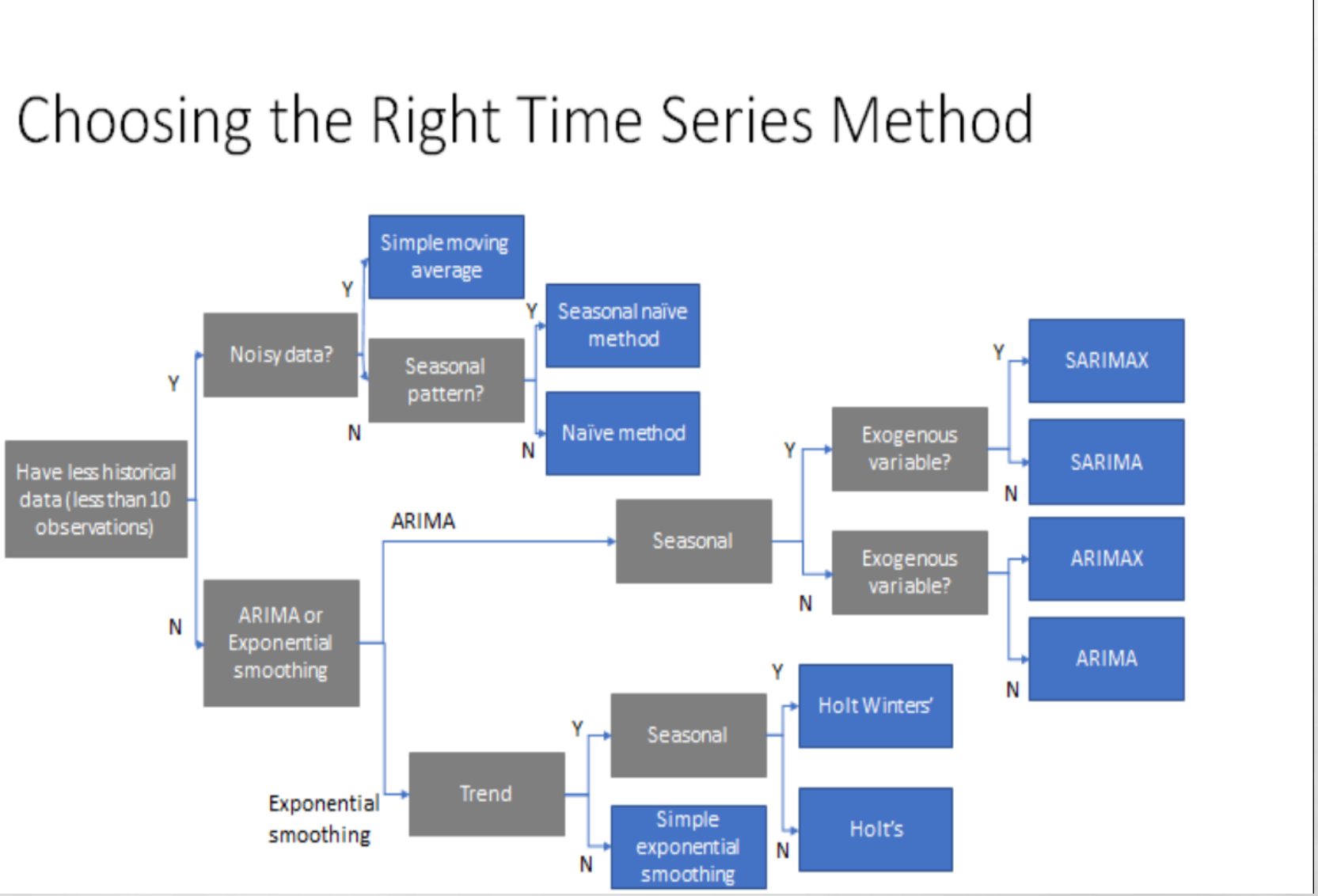
THIS METHOD HAS TREND AND SEASONALITY COMPONENT AND IS FORCASTING ALMOST SIMILAR TO THE ACTUALS.



WHICH METHOD TO USE?

Based on the chart presented at the right side, the current data set contains more than 10 historical data and has seasonal and trend components. Hence,

This makes us choose the ARIMA and exponential smoothing methods



CONCLUSION AND METHOD SELECTION

- Since the data set had more than 10 historical observations, we can rely on the ARIMA and Exponential smoothing techniques
- In the exponential smoothing techniques, **holt winter's additive method** does a better job in forecasting the sales close to the actual.
- In the ARIMA methods, **SARIMA** methods is better than others for forecasting the sales. SARIMA has better RMSE and MAPE values than others.

	Method	RMSE	MAPE
0	Naive method	12355.97	17.47
0	Simple average method	24146.06	34.34
0	Simple moving average forecast	14756.73	15.82
0	Simple exponential smoothing forecast	15011.49	15.99
0	Holt's exponential smoothing method	18976.37	34.57
0	Holt Winters' additive method	9555.61	9.33
0	Holt Winters' multiplicative method	9423.23	11.43
0	Autoregressive (AR) method	10985.28	13.56
0	Moving Average (MA) method	23360.02	33.93
0	Autoregressive moving average (ARMA) method	22654.32	32.40
0	Autoregressive integrated moving average (ARIM...	22654.32	32.40
0	Seasonal autoregressive integrated moving aver...	9621.71	12.89