

# **Global Mart Online Retail - Sales & Demand Forecasting**

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# Business Objectives & Strategy

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## Background & Objective

- *Global Mart* takes on-line orders and delivers across the globe across in 7 different market segments and in 3 major categories
- Forecasting Sales and Demand for the next 6 months helps to manage the revenues and inventory.
- Find out Top 2 among the most profitable and consistent segments from these 21 and forecast the sales and demand for these segments.

## Strategy

- Segment dataset into the **21 Subsets** based on the customer market and customer segment.
- Aggregate measures: *Sales, Quantity and Profit* over the *Order Date* at Month level.
- Find 2 most consistently profitable segments as *Coefficient of Variation*
- Use **Classical Decomposition** and **Auto ARIMA** for forecasting the *Sales* and *Demand*.
- Evaluate models accuracy with **MAPE** to arrive at the best possible model for each series

# Problem Solving Methodology – Analysis Flow

## Find Top 2 most profitable segment(Data Preparation)

**Step 1 - Aggregate Sales , Quantity and Profit on the Customer market & Segment and Month level**

**Step 2 - Find Top 2 most consistently profitable Segment by using the Coefficient of Variation of Profit**



## Build and Train the Model on the prepared timeseries

**Step 3 - Analyze Trend & Seasonality and arrive at Smoothened Time Series for Sales and quantity for Top 2 Market Segments**

**Step 4 – Build model by using Classical Decomposition and Auto ARIMA**

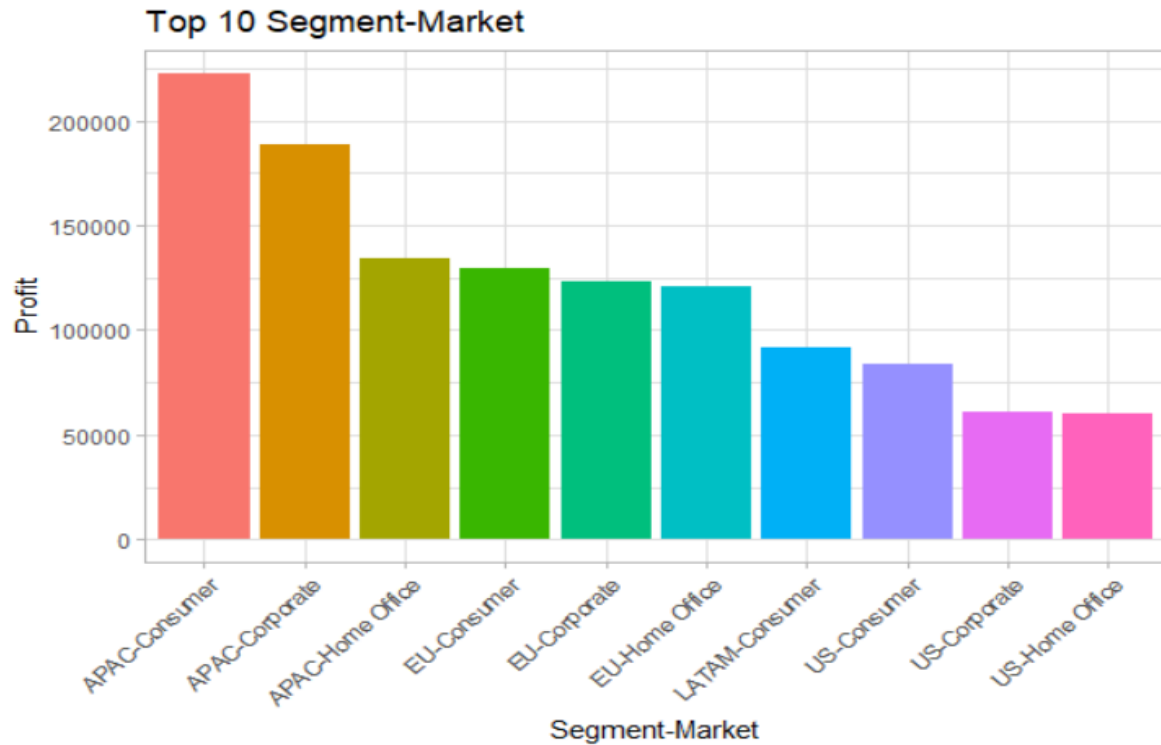


## Evaluate and Predict using Model

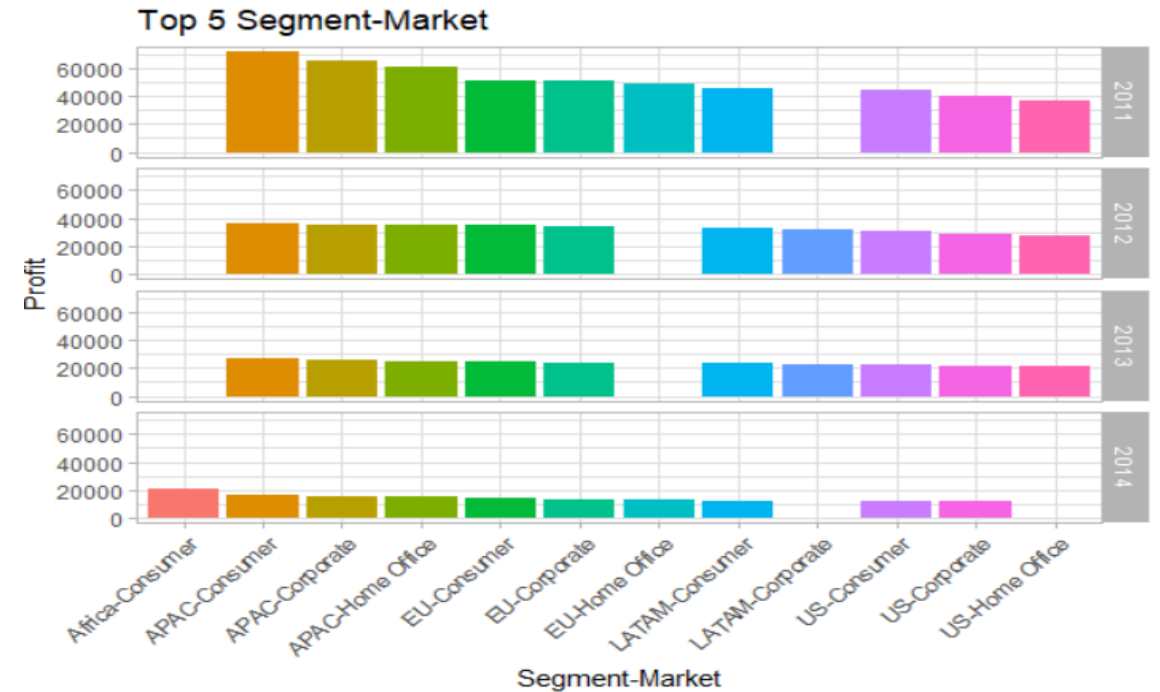
**Step 5 – Test the accuracy of the forecast by the help of MAPE Score using last 6 months**

**Step 6 – Forecast the Sales & Quantity for the next 6 months**

# Top 10 Profitable Market Segments



**Figure:** Shows Top 5 most profitable Market Segments – APAC-Consumer, Corporate, Home office, EU-Consumer and Corporate



**Figure:** The highlighted are **consistently Top 5 Profitable Market Segments** - APAC-Consumer, Corporate, Home office, EU-Consumer and Corporate

# Top 2 Consistently Profitable Segments

Table below shows the Top 10 Consistently Profitable Market segment. Finalize on top 2 by ordering on the basis of Profit and *Coefficient of Variation*.

Market Segment	Coefficient of Variation	Profit	
APAC-Consumer	4.21	222818	Preferred Choice 1
EU-Consumer	4.72	188688	Preferred Choice 2
US-Consumer	9.39	134119	
APAC-Corporate	4.23	129737	
EU-Corporate	4.78	123394	
LATAM-Consumer	5.44	120633	
US-Corporate	7.62	91979	
APAC-Home Office	4.63	83445	
EU-Home Office	4.92	60748	
US-Home Office	6.28	60299	

# Time Series Plots for Sales and Demand



**Figure:** Plot showing Sales and Quantity of Sale for both the Segments. They all are in upward Trend

# Time Series Models - Classical Decomposition

## APAC – Consumer Model

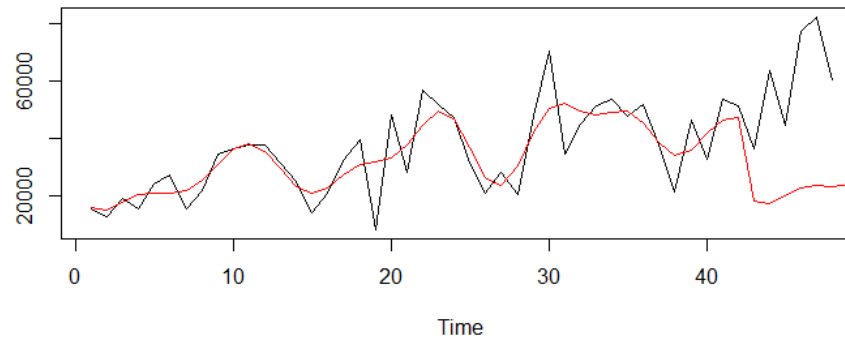
### Sales

```
lm(Sales ~
  sin(0.5*Month) *
  poly(Month,3) *
  cos(0.5*Month) +
  Month,
  data =
  in_data_Sales_smoothTS
  _MarketSegment1)
```

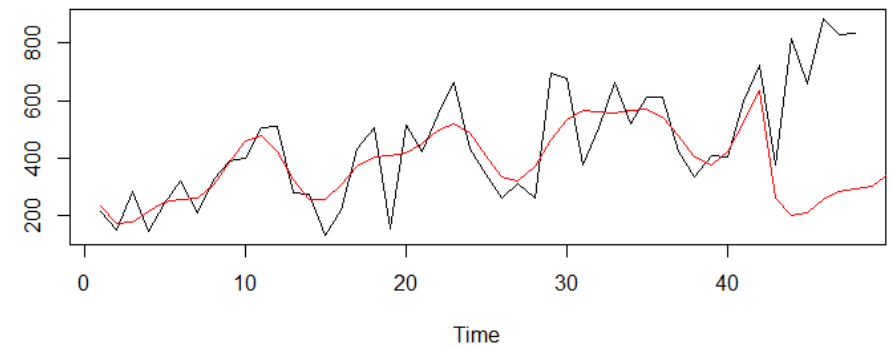
### Quantity

```
lm(Quantity ~
  sin(0.5*Month) *
  poly(Month,1) *
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  Month,
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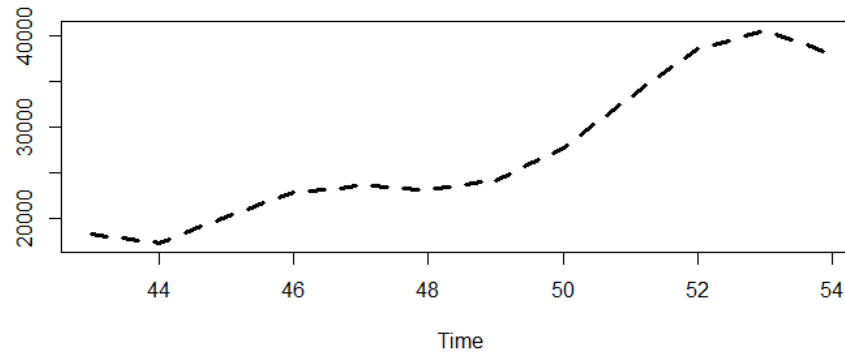
Model Evaluation and Forecast for Sales in APAC-Consumer



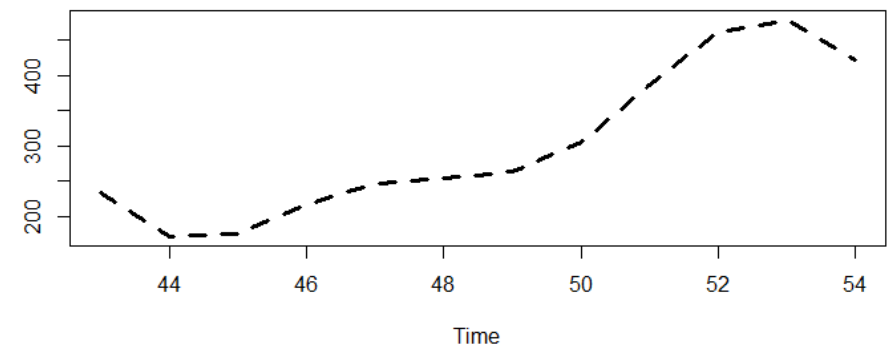
Model Evaluation and Forecast for Quantity in APAC-Consumer



Sales Forecast



Quantity Forecast



**Figure:** Sales data for APAC – Consumer

**Figure:** Quantity data for APAC – Consumer

# Time Series Models - Classical Decomposition

## EU – Consumer Model

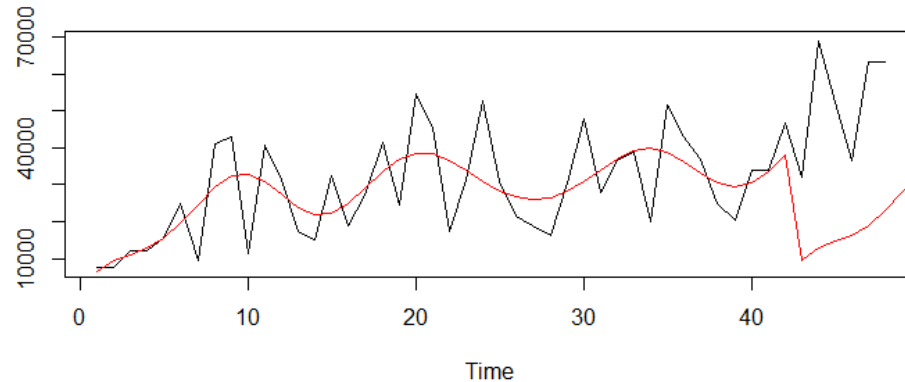
### Sales

```
lm(Sales ~ sin(0.6*Month)
* poly(Month,3) +
cos(0.6*Month) *
poly(Month,3) + Month,
data =
in_data_Sales_smoothTS_
MarketSegment2)
```

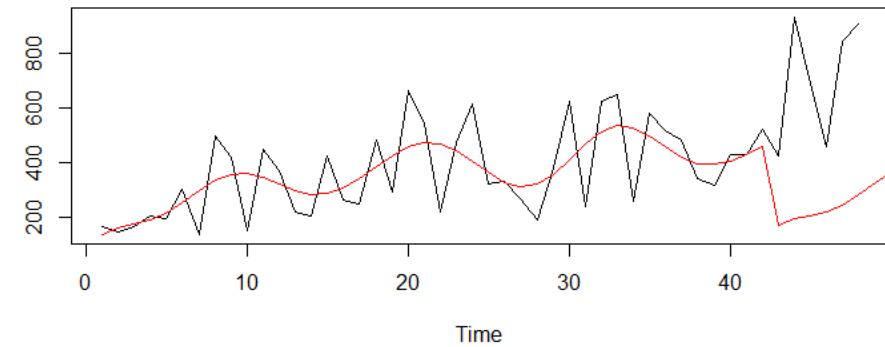
### Quantity

```
lm(Quantity ~
sin(0.6*Month) *
poly(Month,3) +
cos(0.6*Month) *
poly(Month,3) + Month,
data =
in_data_Quantity_smooth
TS_MarketSegment2)
```

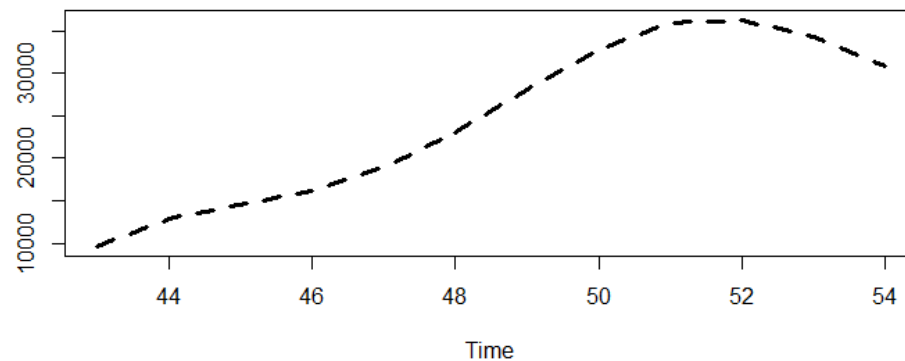
Model Evaluation and Forecast for Quantity in EU-Consumer



Model Evaluation and Forecast for Quantity in EU-Consumer



Quantity Forecast



Quantity Forecast

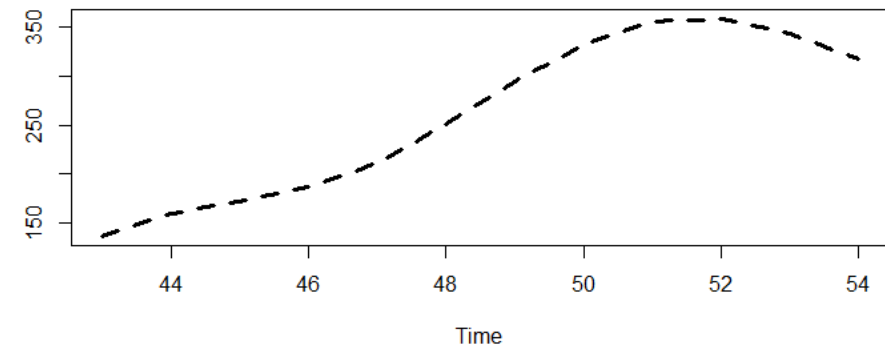


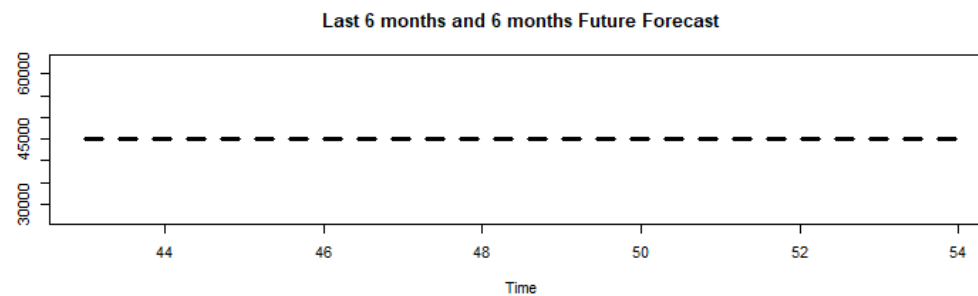
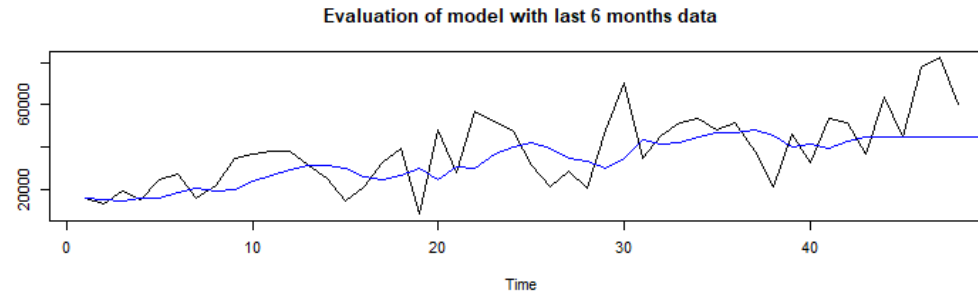
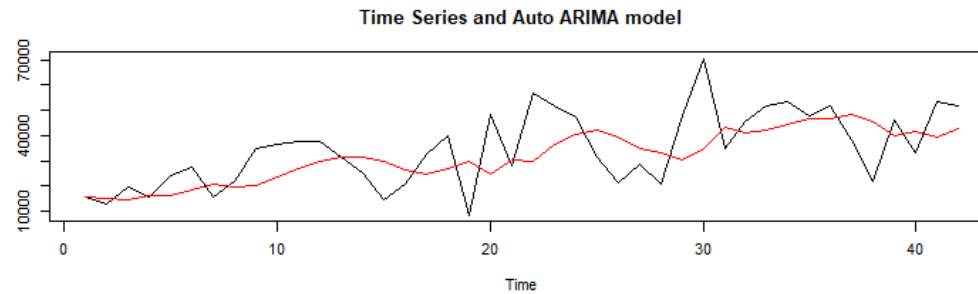
Figure: Sales for EU – Consumer

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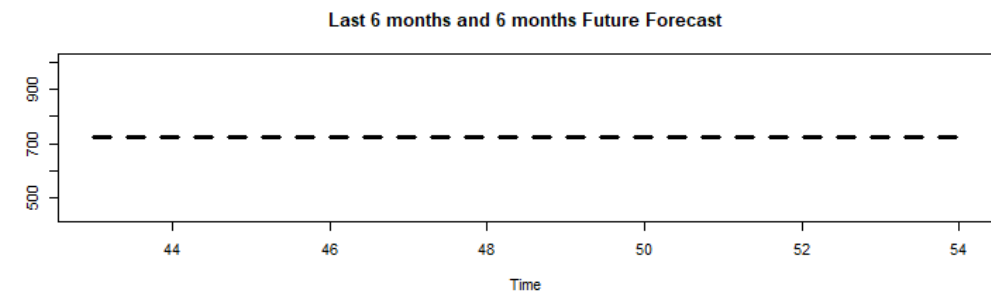
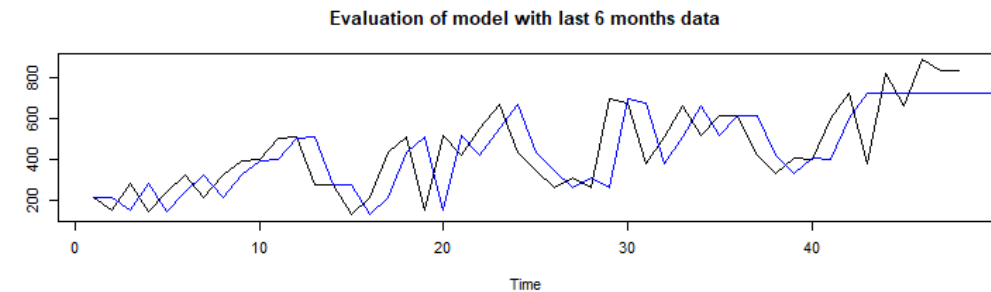
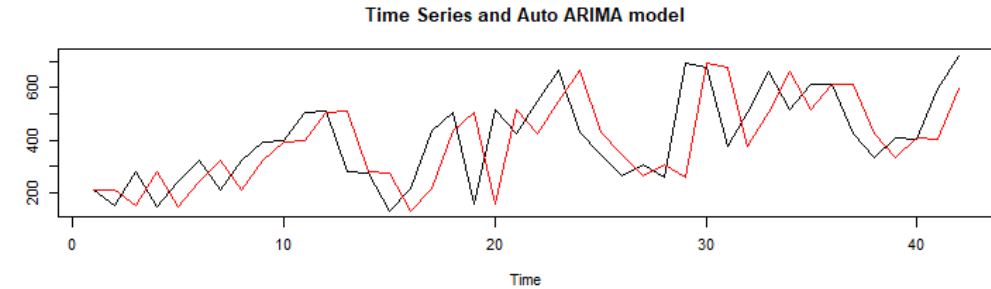


# Time Series Models - Auto ARIMA

**Figure: Auto ARIMA for APAC - Consumer**



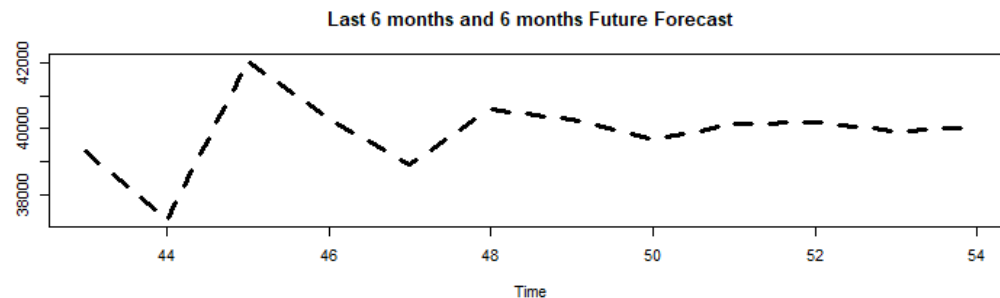
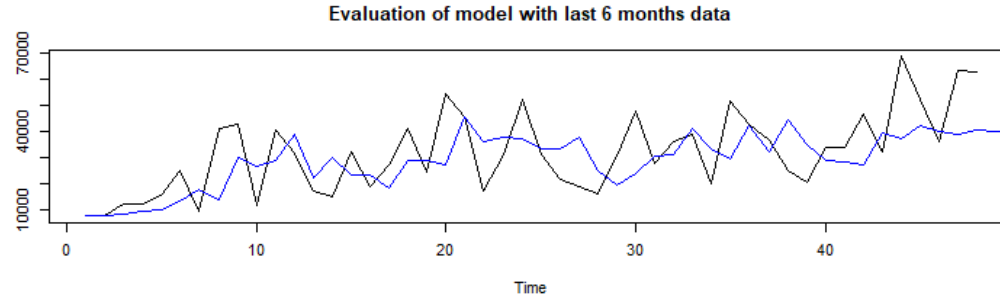
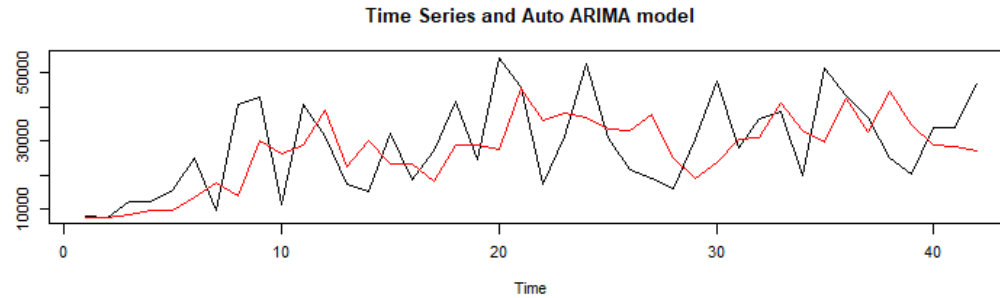
**Figure: Sales for APAC – Consumer**



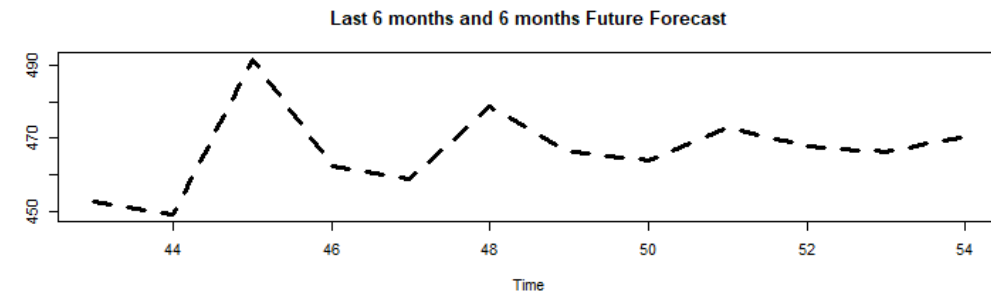
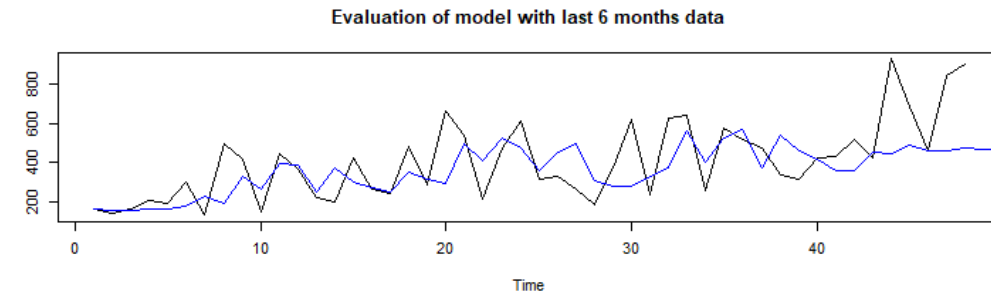
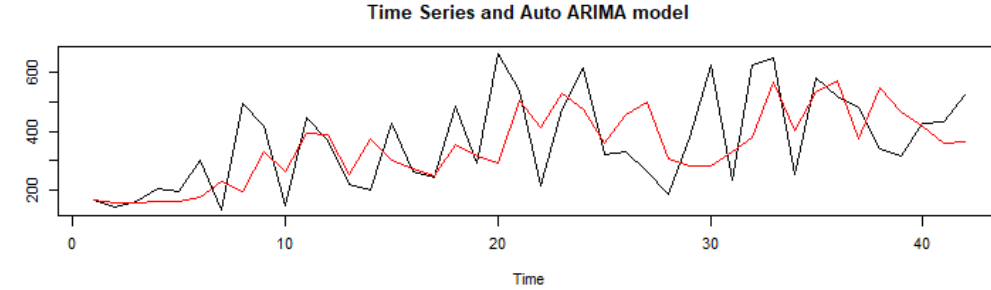
**Figure: Quantity for APAC – Consumer**

# Time Series Models - Auto ARIMA

**Figure: Auto ARIMA for EU - Consumer**



**Figure: Sales for EU – Consumer**



**Figure: Quantity for EU – Consumer**

# Recommendations

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- Out of total 21 Segment – Markets, the two Segment – Markets to focus for next six months would be **“APAC – Consumer”** and **“EU – Consumer”**.
- Classical Decomposition Model is performing better than the Auto – ARIMA model.
- It is forecasted that for APAC – Consumer, sales and requirement of products for next 6 months it is going to be the same as current. It is advised to keep the inventory levels at current levels.
- It is recommended the same for EU – Consumer as well.!