Retail-Giant Sales Forecasting- Case study using time series

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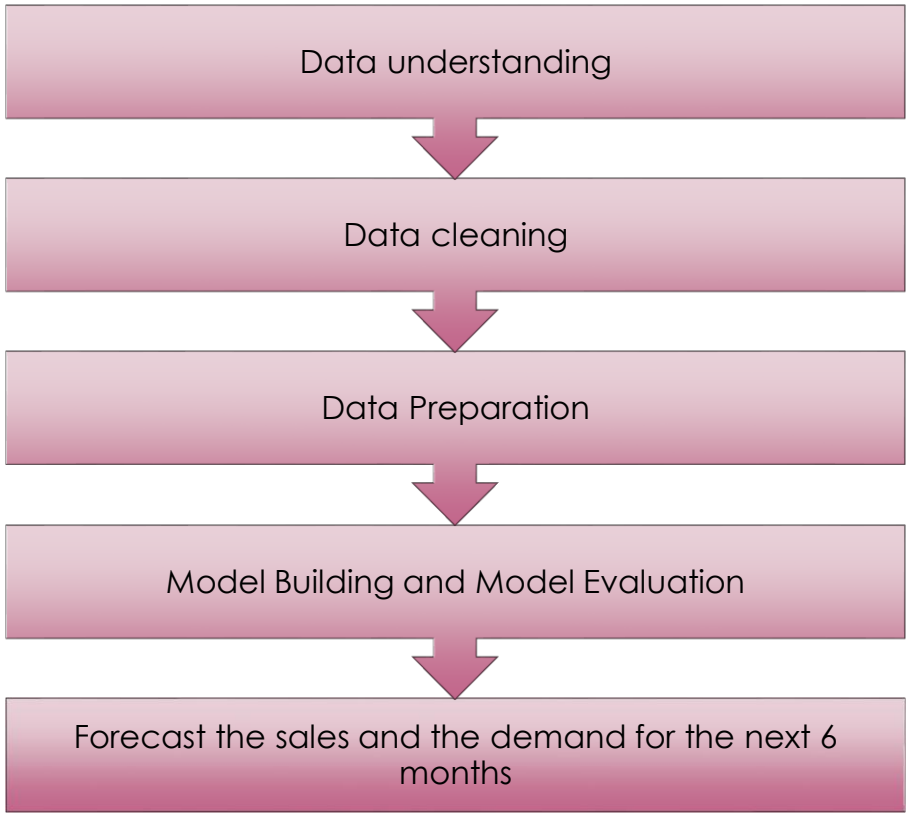
INTRODUCTION

- Preamble: A online Store 'Global Mart' takes orders and delivers across the globe and deals with all the major product categories .
  - Markets - Africa, APAC, Canada, EMEA, EU, LATAM, US
  - Segments - consumer, corporate & home office Case study objective
- Objective
  - To forecast sales and demand for next six months
  - So that it will be helpful to manage the revenue and inventory accordingly.

Methodology followed



Input data – Preliminary understanding

We have data of 51290 observation of 24 variables of Global Mart

- Global Superstore Transactional Level data
  - Order Purchase date and shipped date details
  - Customer details, Product details, Postal codes
  - Sales, Quantity, Profit Details
  - Checked duplicated rows – No duplicate records found
  - Checked NA values, NA found only for postal code, No action taken as it is insignificant
  - Checked Blank Values, No blank values found

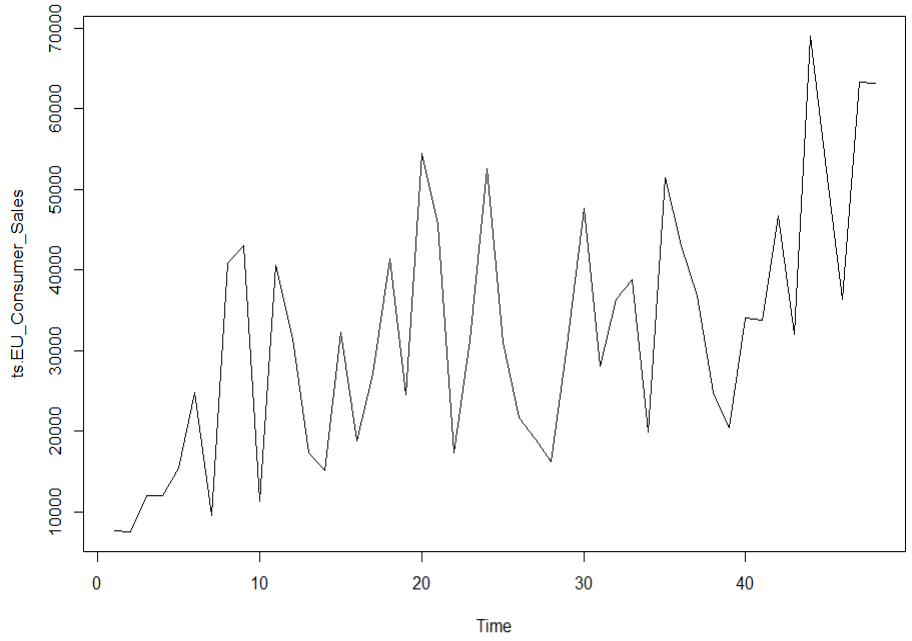
Data Cleaning and Preparation

- Date format was set to mon-yyyy
- Segment and market column converted to factor
- Segmented data by grouping the whole data into 21 separate subset based on market and customer segment
- Converted transactional-level data into time series
- Arranged data for each segment in chronological order
- Aggregated Sale, Quantity and Profit over date for all segments
- Found 2 most profitable and consistent profitable segments using Coefficient of Variation method for profit
  - EU - Consumer
  - APAC - Consumer

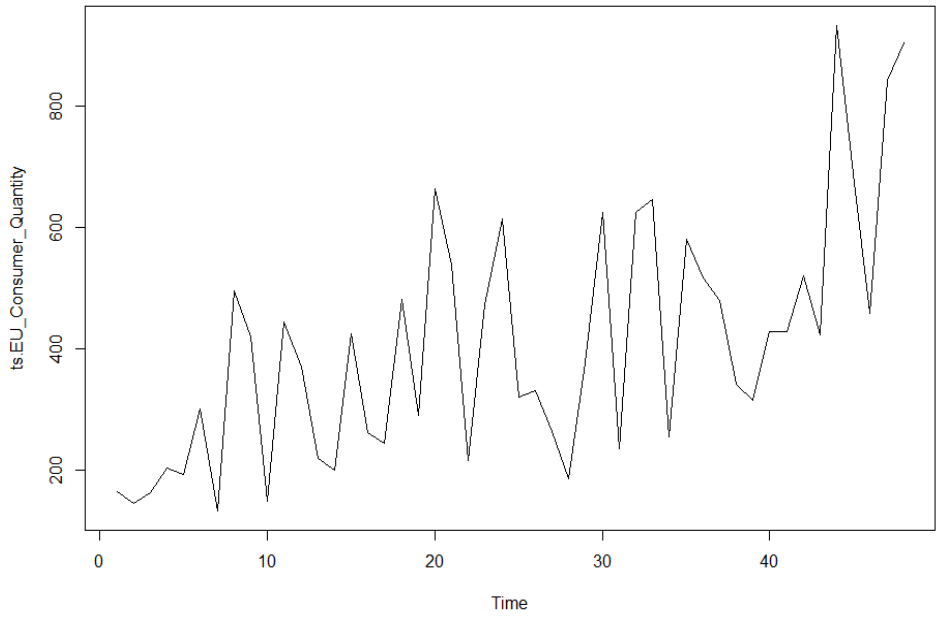
Data Preparation

- Created 4 time series of 48 months for sales and quantity of two most profitable and consistent segments,
- We found Upward trend and yearly seasonality

EU consumer sales time series plot



EU consumer quantity time series plot



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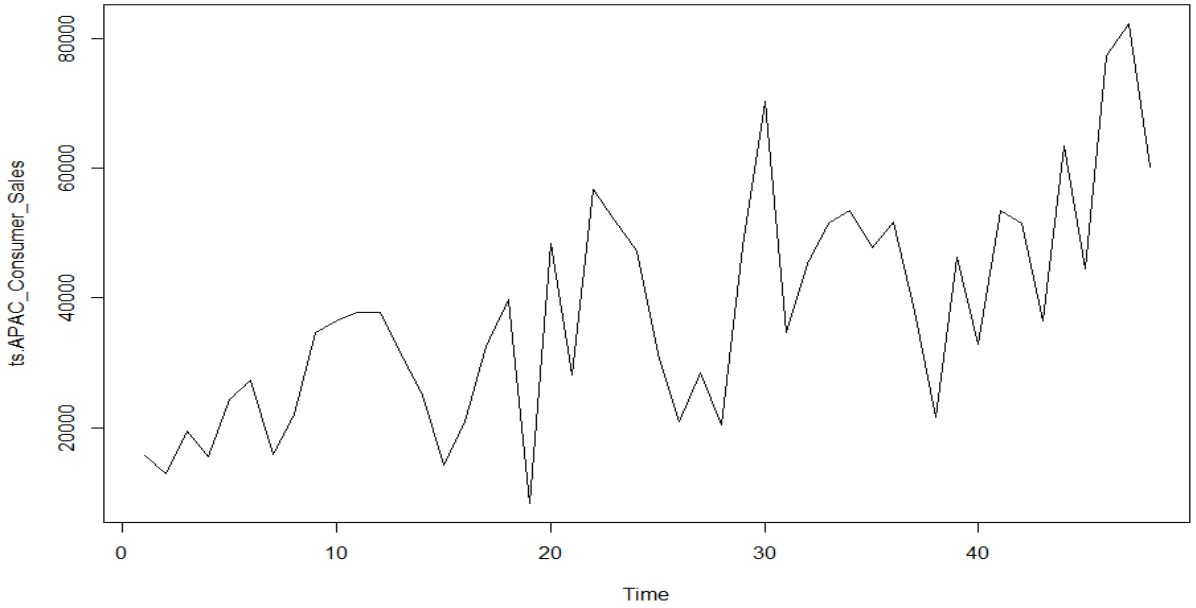
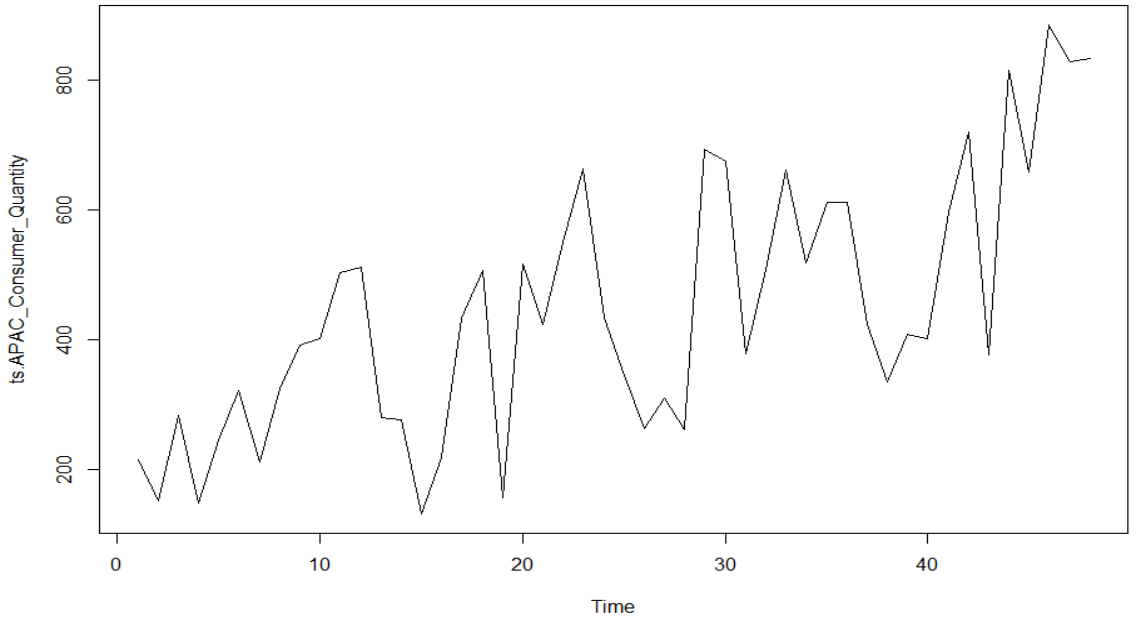
APAC consumer sales time series plot



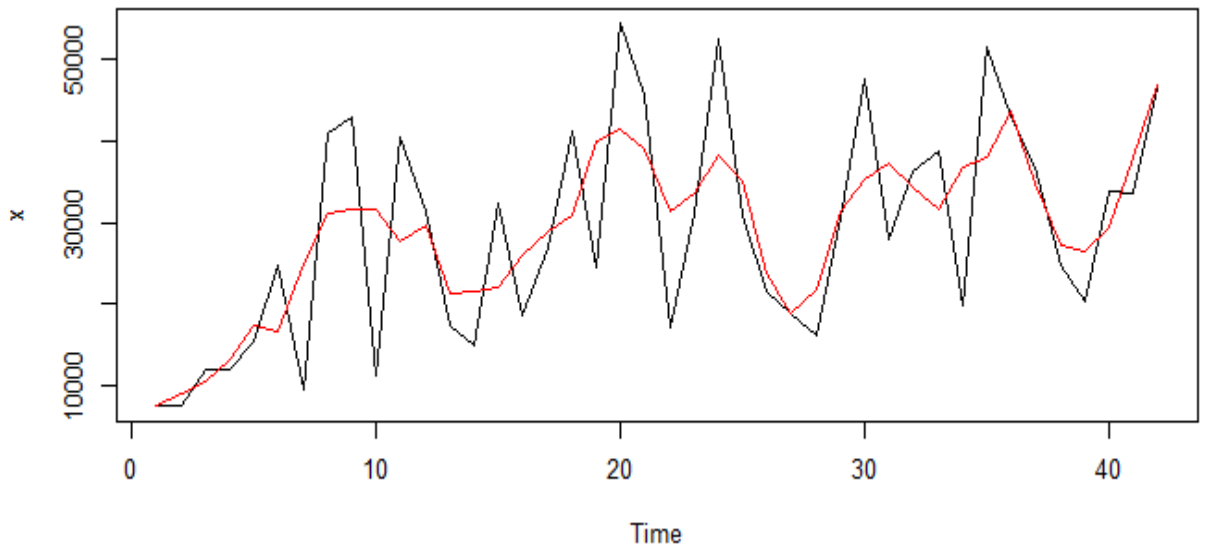
APAC consumer quantity time series plot



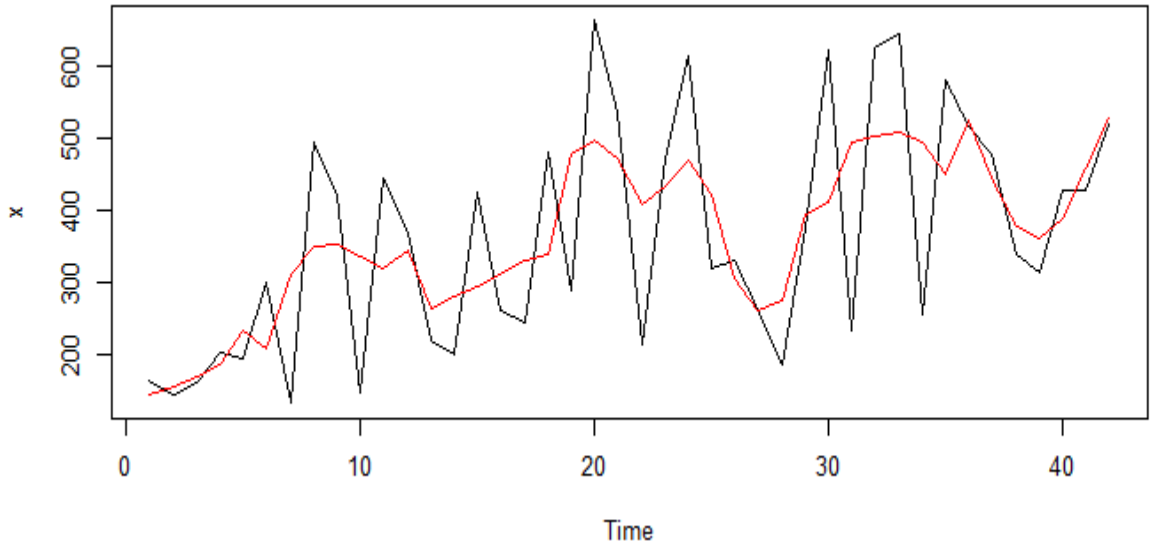
Model Building

- Used Moving Average Method with width 3 to smoothened four the time series on training data of 42 months

Smoothened EU consumer sales time series plot



Smoothened EU consumer sales time series plot



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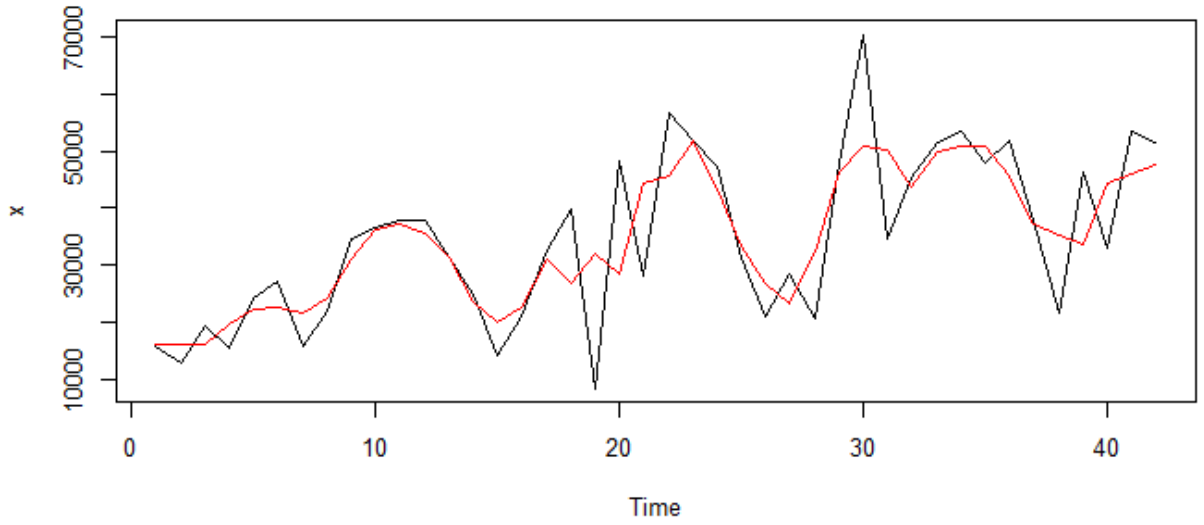
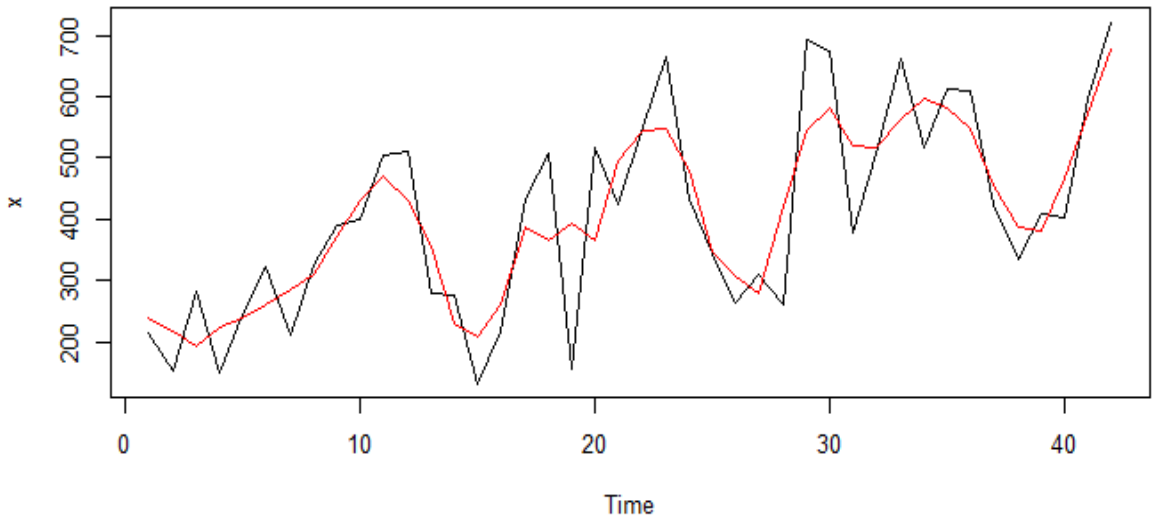
Smoothened APAC consumer sales time series plot



Smoothened APAC consumer sales time series plot

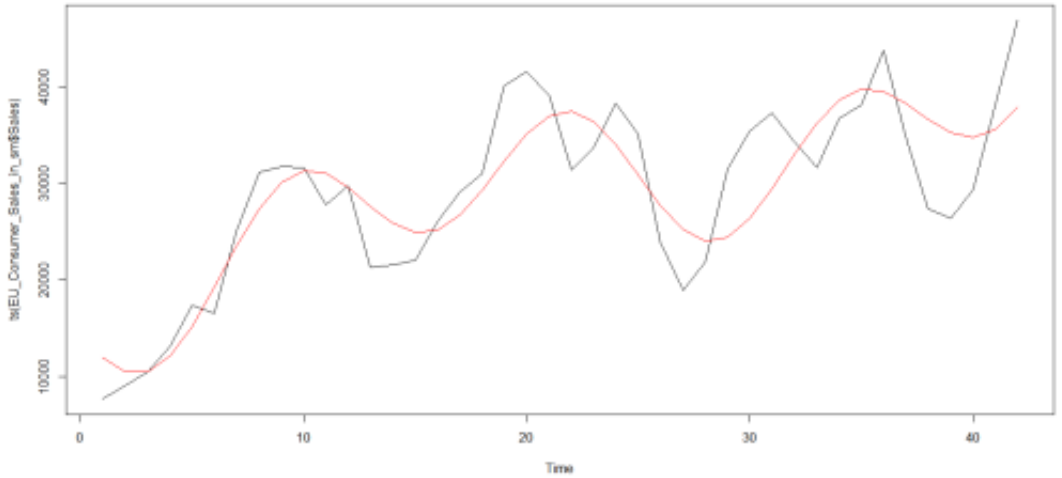


Model Building and Evaluation

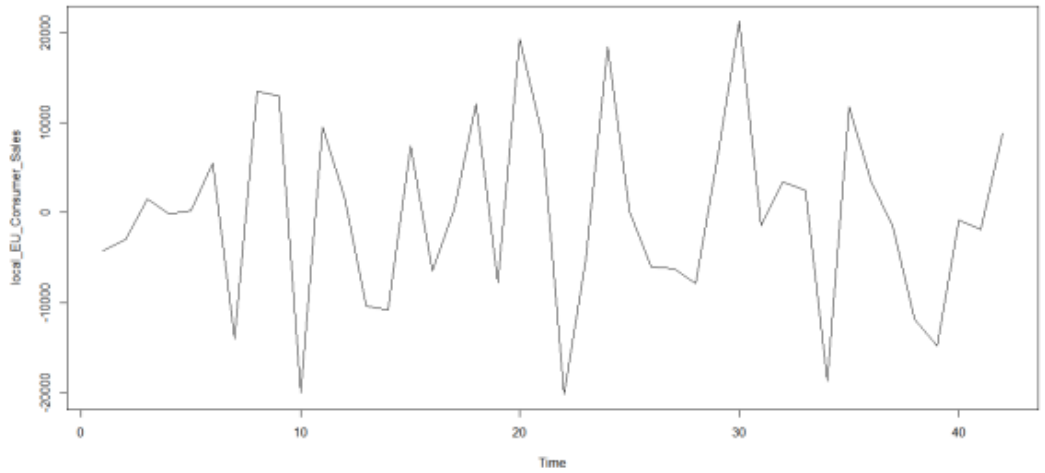
- Model building was done using 2 methods – Classical Decomposition and Auto ARIMA
- Build linear model on all four segment for 42 months
- Adjusted sin and cosine values for model with trial and error to get good prediction
- Predicted global sale and quantity for both the segments
- Identified local component for both segments
- Identified stationarity using ACF and APAC functions
- Confirmed the stationarity of LOCAL/RESIDUAL using ADF and KPSS test
- Forecasted for next 6 months
- Checked the accuracy with MAPE
- Plotted original time series against the forecasted values

Model Outcome EU-Consumer Sale

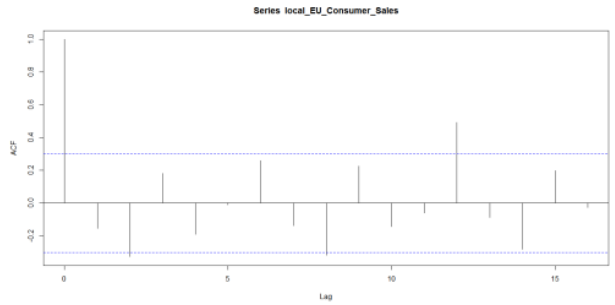
Global Component

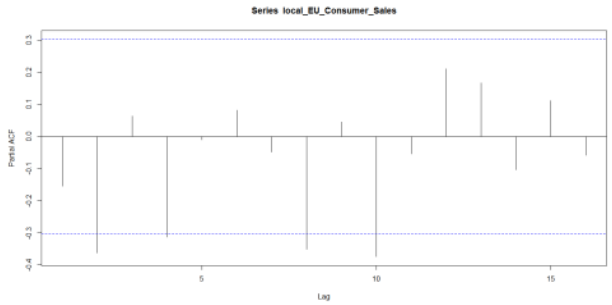


Local Component



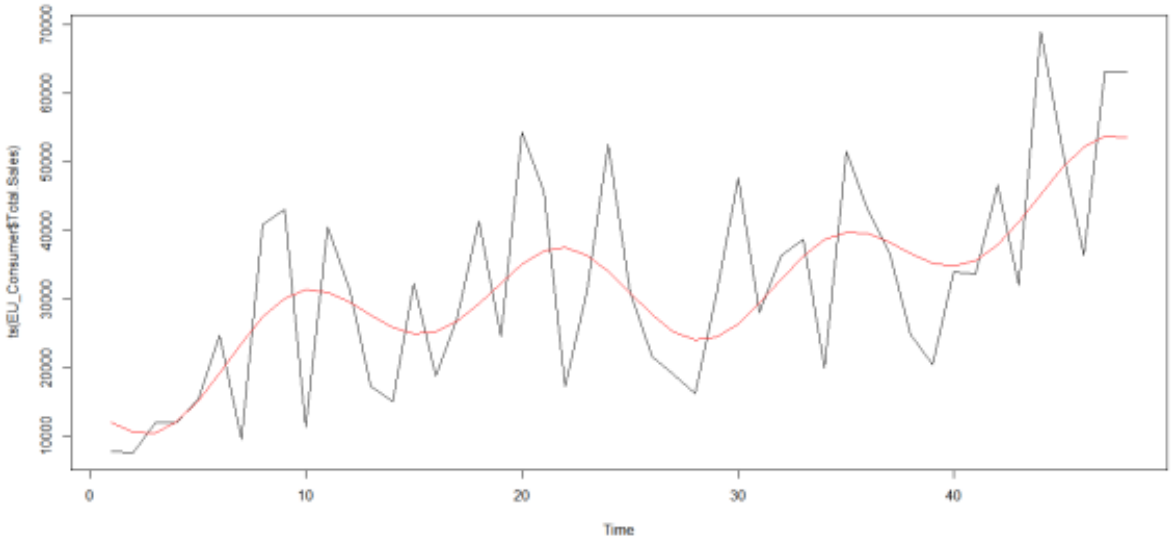
ACF & PACF plots



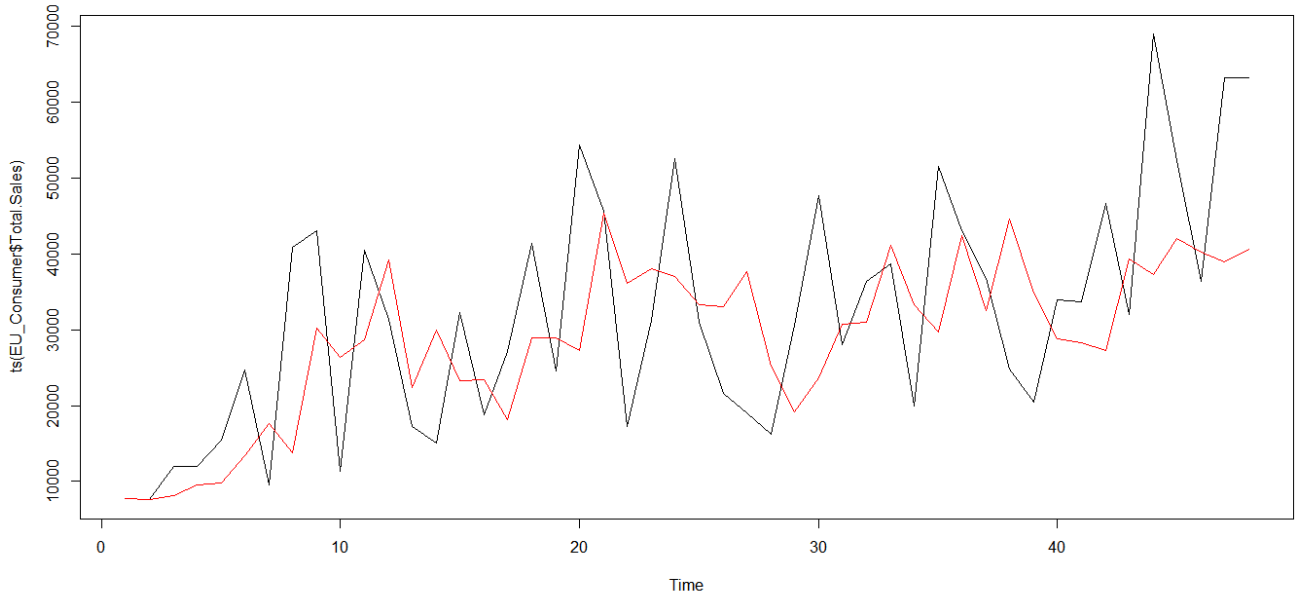


Model Predictions EU-Consumer Sale

Classical Decomposition Method

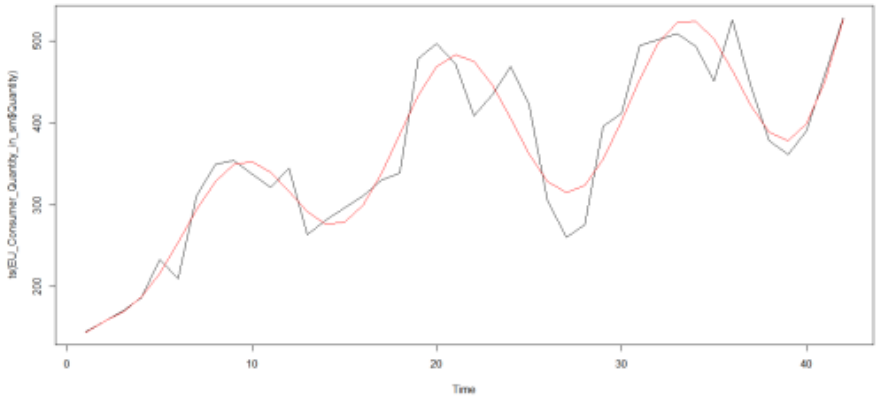


Auto ARIMA

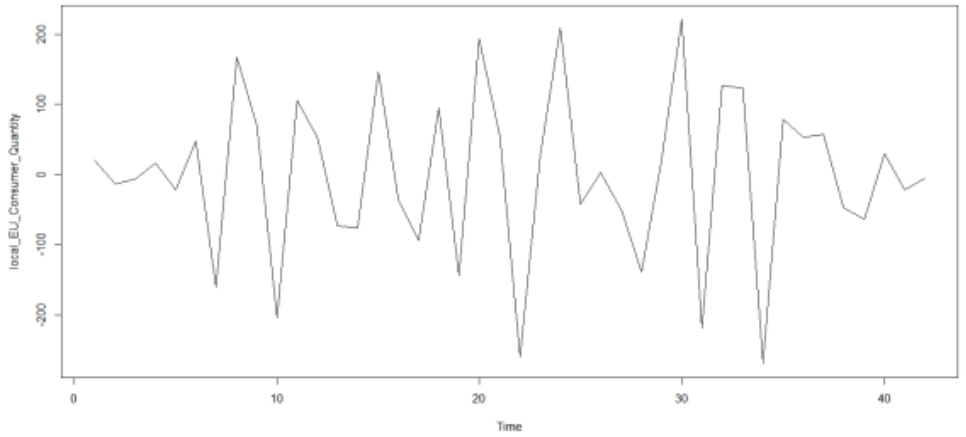


Model Outcome EU-Consumer Quantity

Global Component



Local Component



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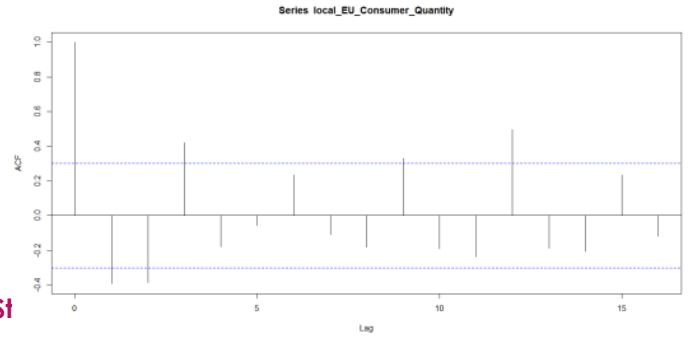

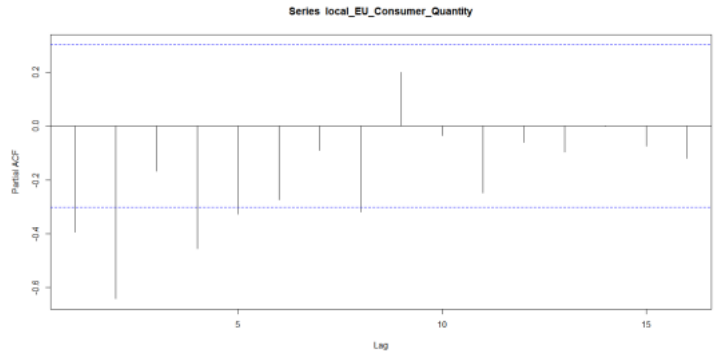

Model Predictions EU-Consumer Quantity

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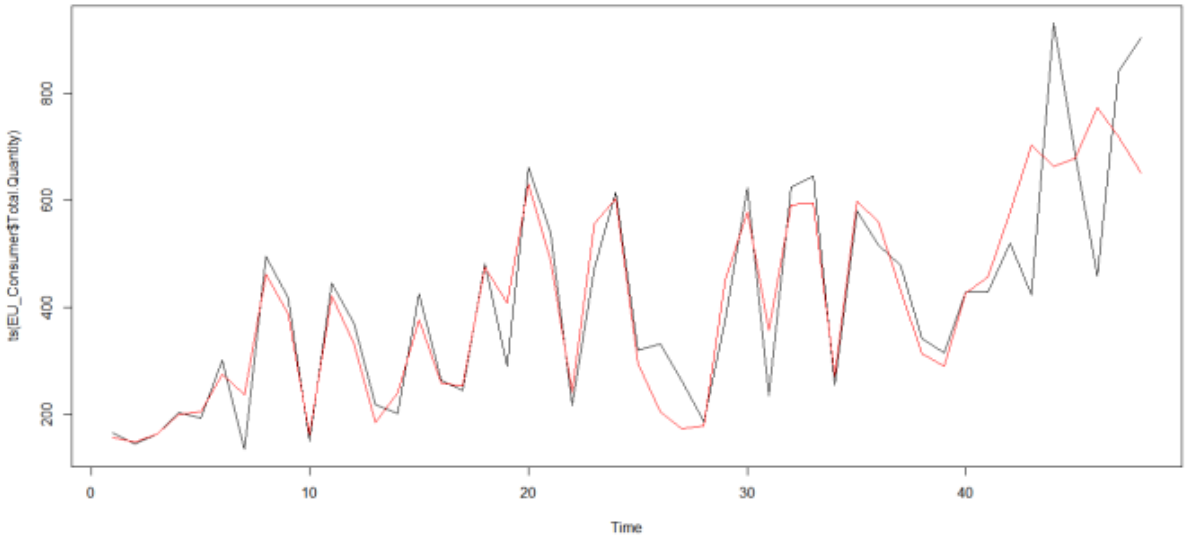

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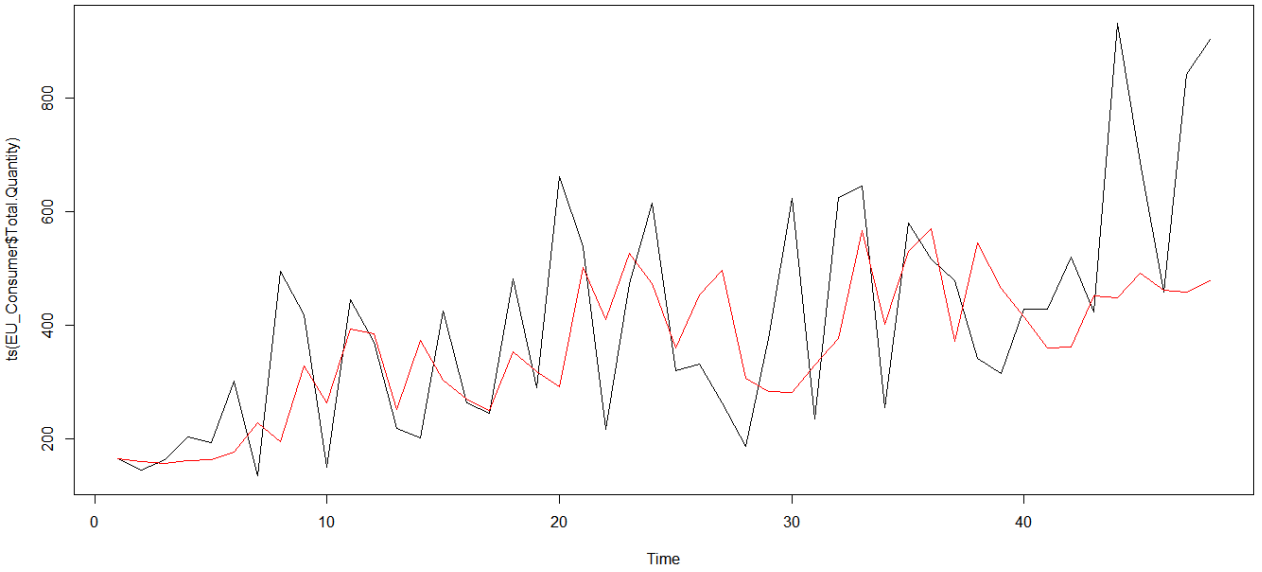
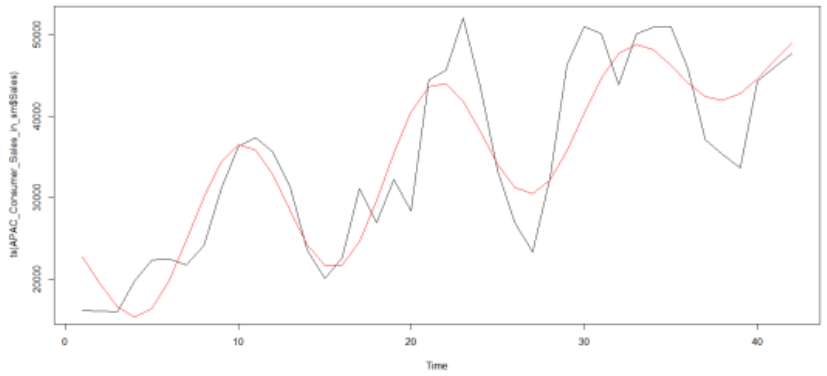


Model Outcome APAC-Consumer Sales

Global Component



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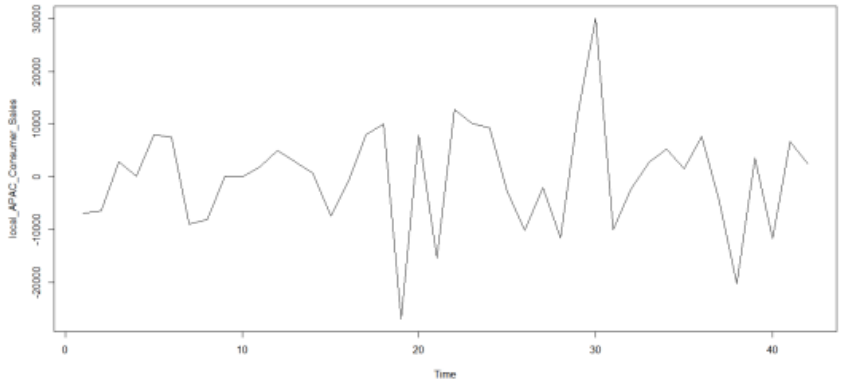

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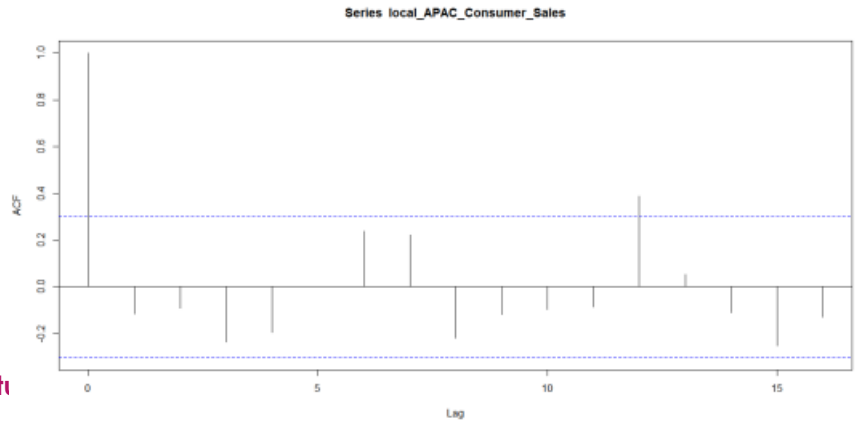

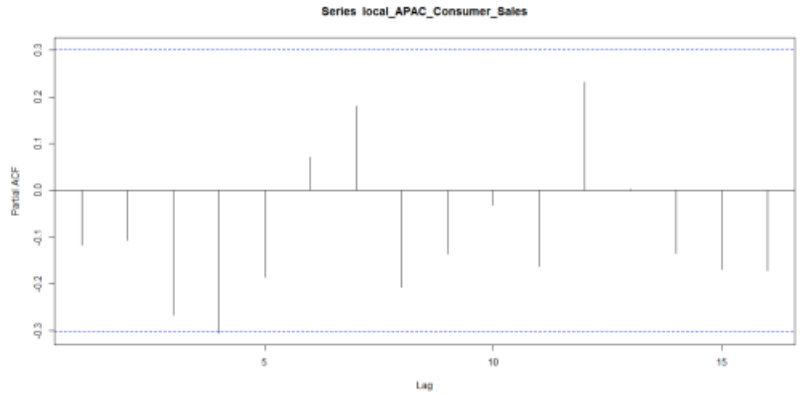

Model Predictions APAC-Consumer Sales

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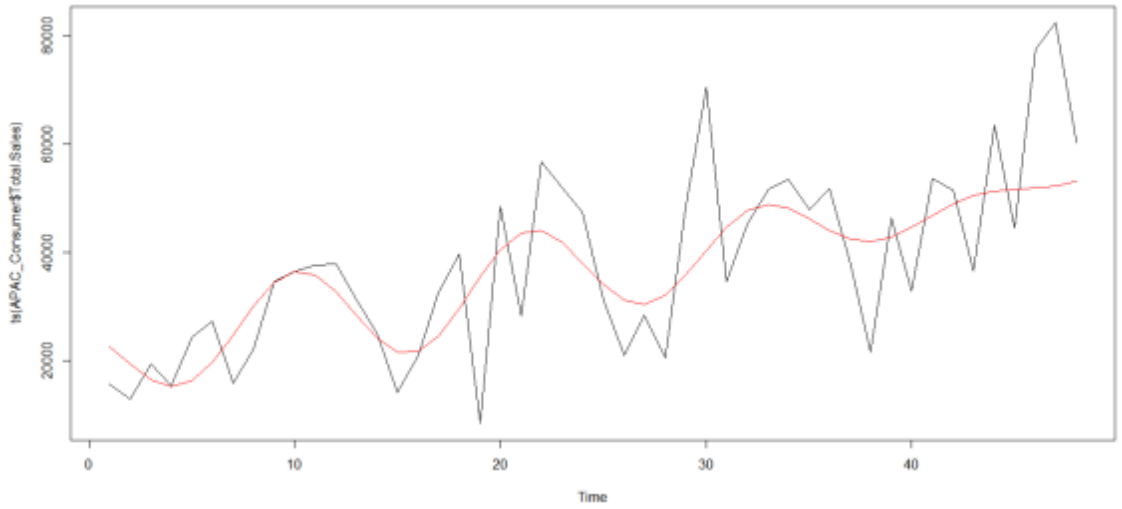

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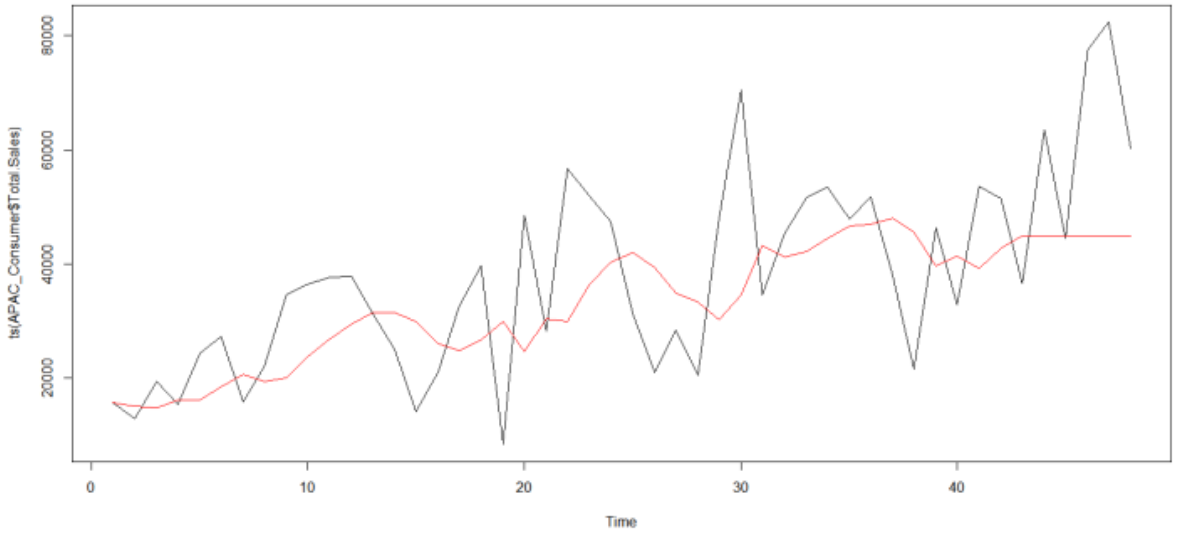

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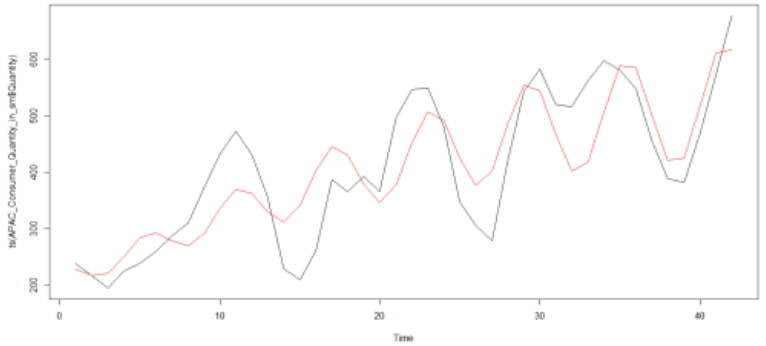

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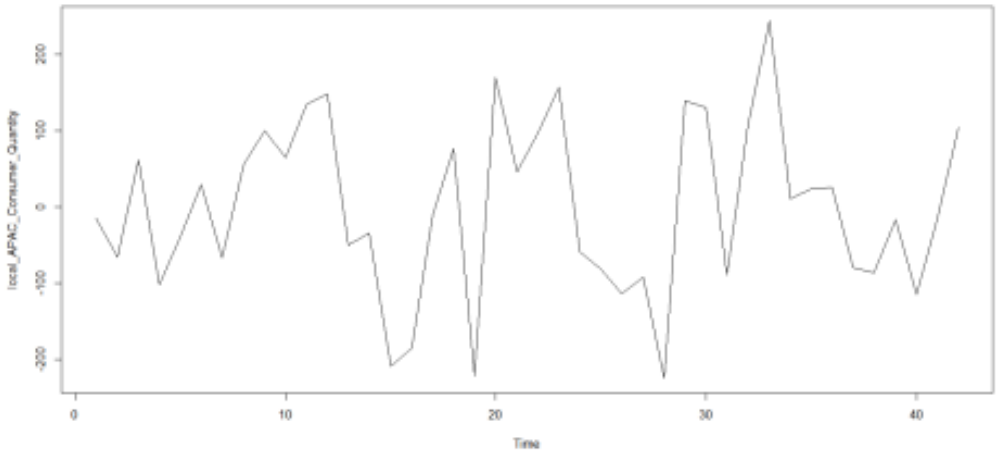

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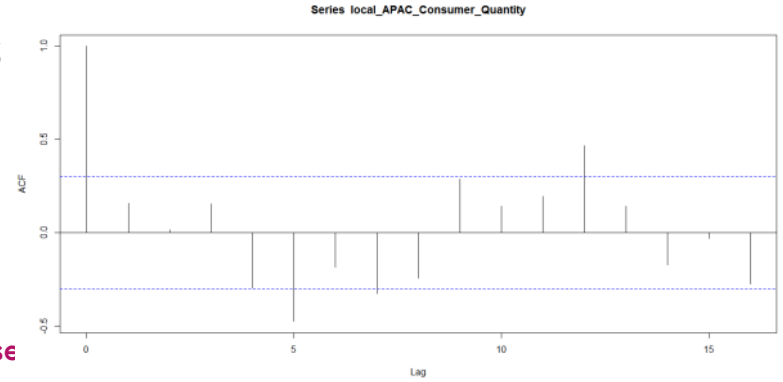

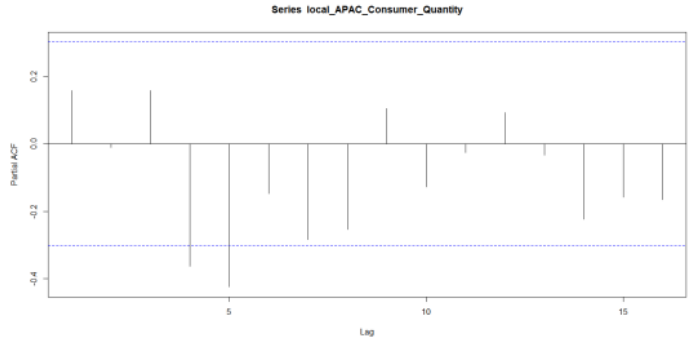

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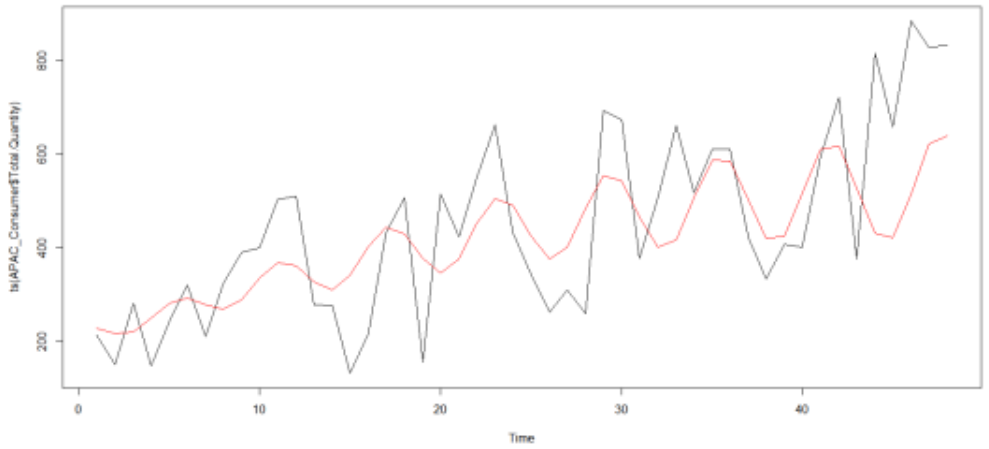

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