

RETAIL-GIANT (Global Mart Online Store) SALES AND DEMAND FORECASTING

CASE STUDY SUBMISSION

BNS Analytics:

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Business Objective and Goal

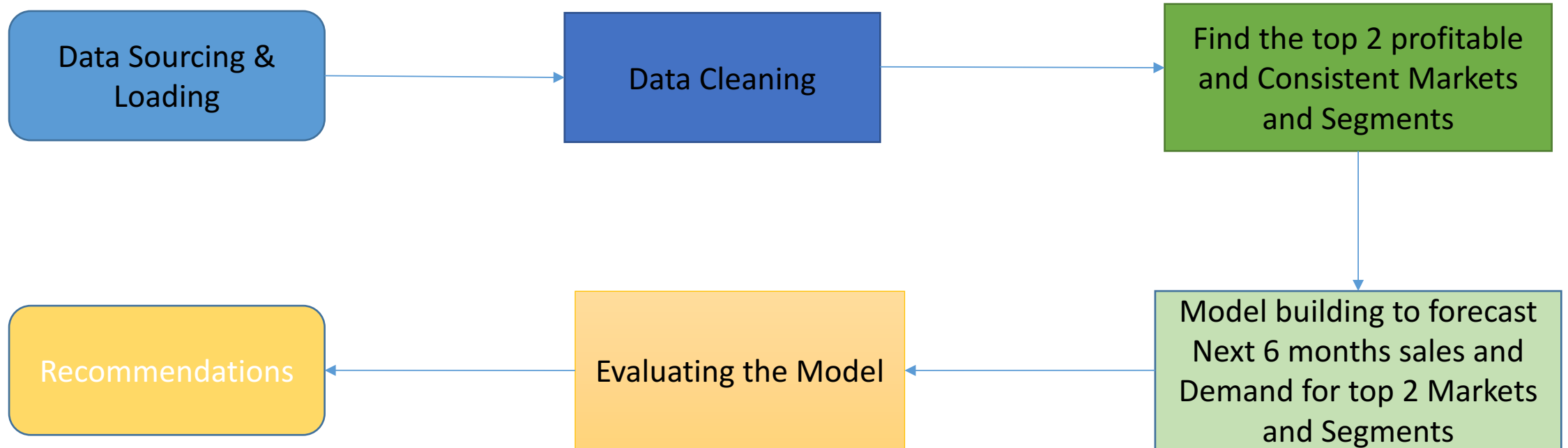
❑ Business Objective :

- Forecast Sales and Demand for Next 6 Months in order to plan/manage revenue and inventory for top 2 Markets and Segments.

❑ Data Analysis Goals :

- Find the top 2 profitable and Consistent Markets and Segments
- Build a time series model to forecast next 6 months Sales and Demand.
- Evaluate the Model.

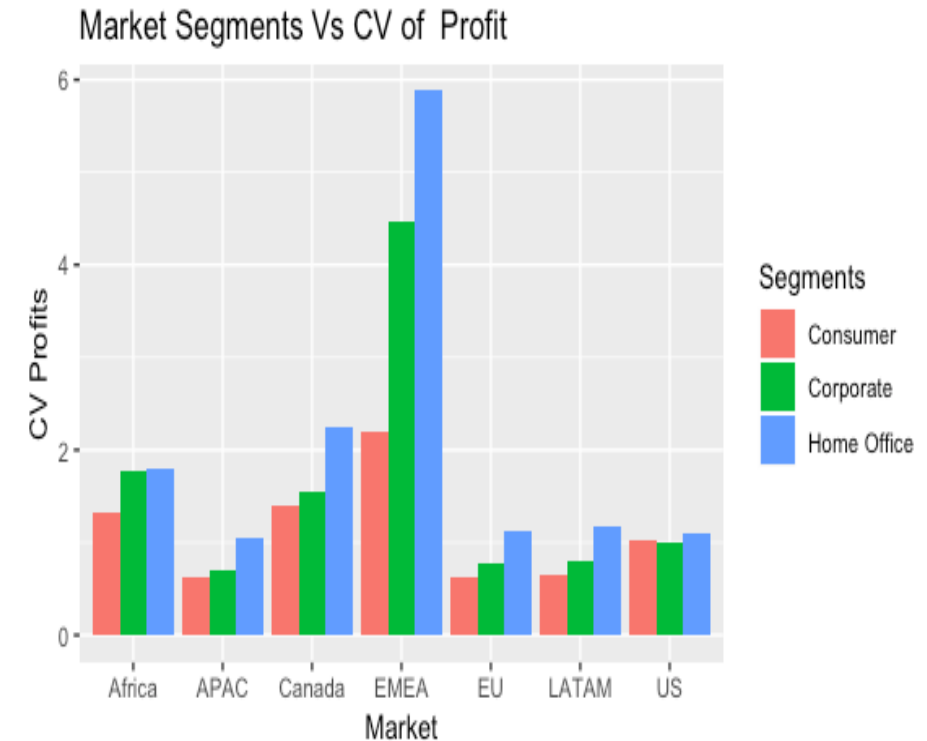
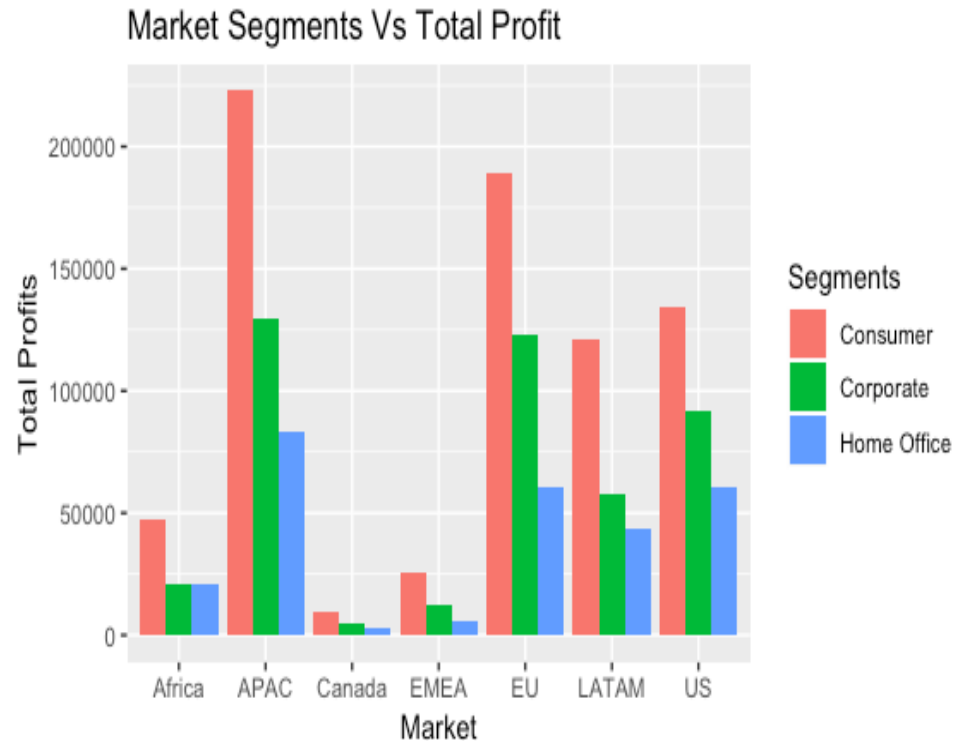
Problem solving methodology – Flow Chart



Data Cleaning and Preparation Steps

- Checking for missing values, Postal Code Column has 41296 missing values and this column wont be helpful in analysis , hence removing it.
- Updating date time column data types
- Removing unwanted columns like RowID , CustomerID , OrderID , ProductID.
- Considering Order. Date , Sales , profits and Quantity for Analyzing all the 7 Markets and 3 Customer Segments to find the top 2 Market-Segment , which are most profitable and consistently profitable.

Top Two Markets and Segments

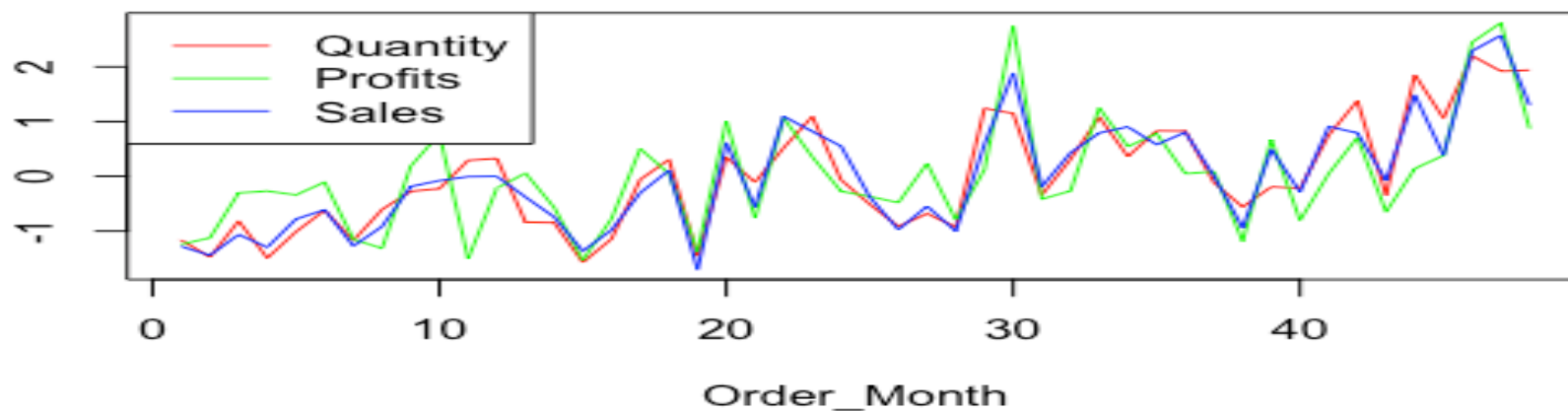


Based on the above graphs, we selected

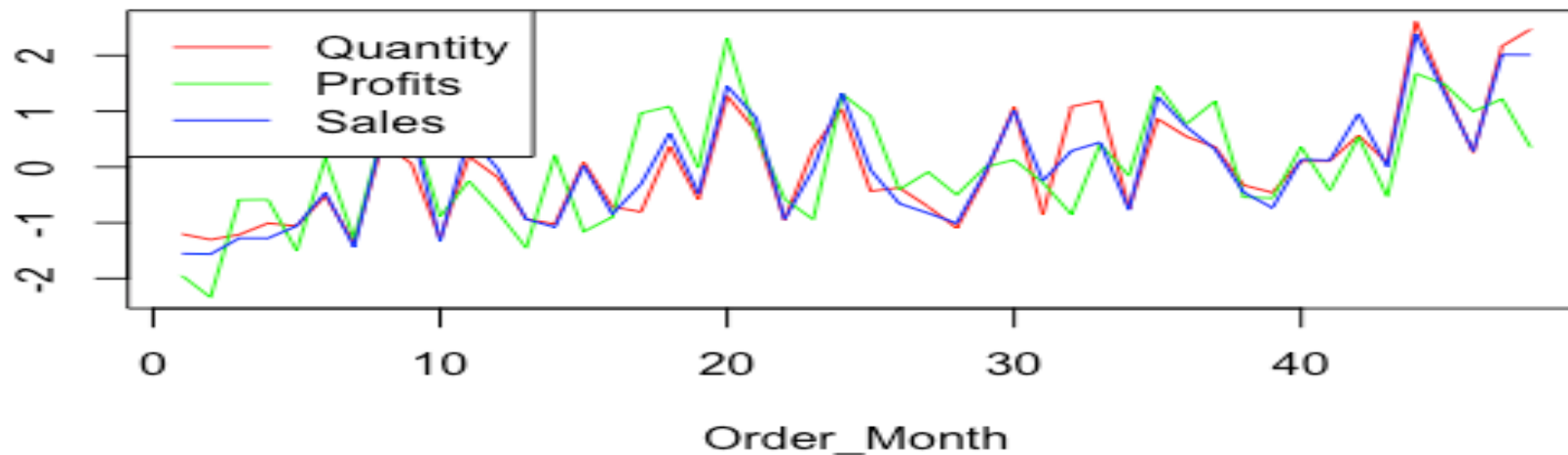
1. APAC Consumer with total Profits of 222817.560 USD and low Coefficient of Variance 0.632
2. EU Consumer with total Profits 188687.707 USD and low Coefficient of Variance 0.6243

Time Series for APAC Consumer and EU Consumer

Sales for APAC_Consumer

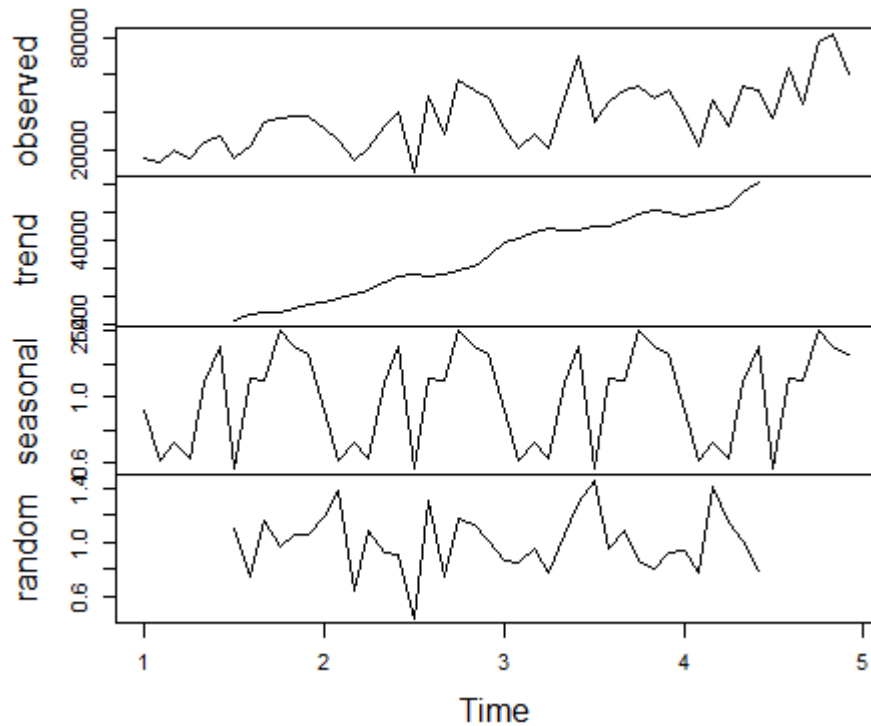


Sales for EU_Consumer



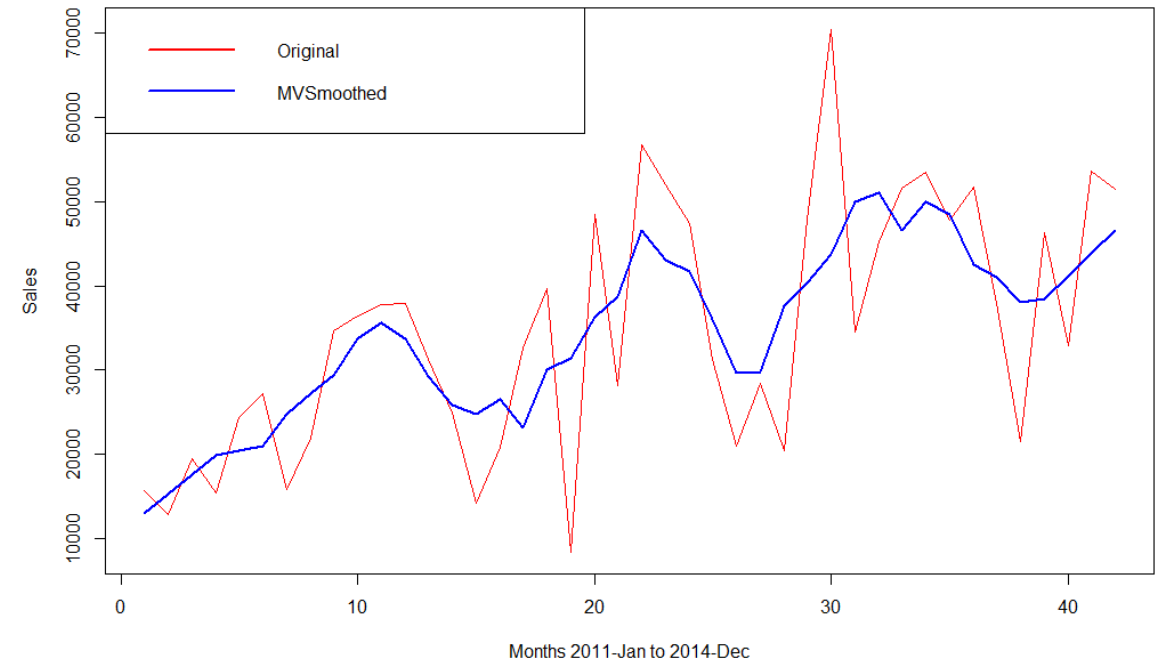
Analyzing Sales for APAC Consumer

Decomposition of multiplicative time series



- Sales for APAC Consumer during Jan-2011 to Dec-2014 show an increasing trend with a seasonality

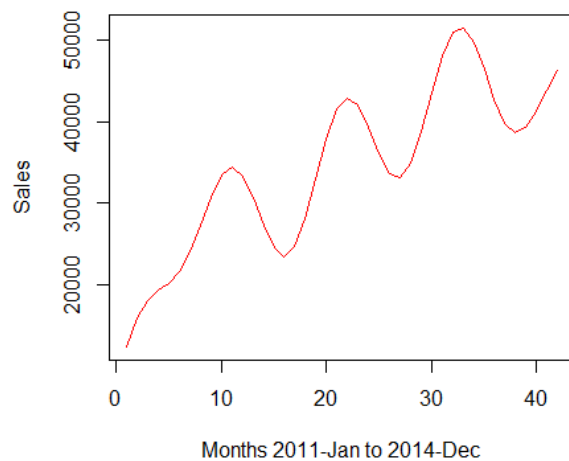
Global Mart Sales in APAC Market Consumer Segment from 2011-Jan to 2014-Dec



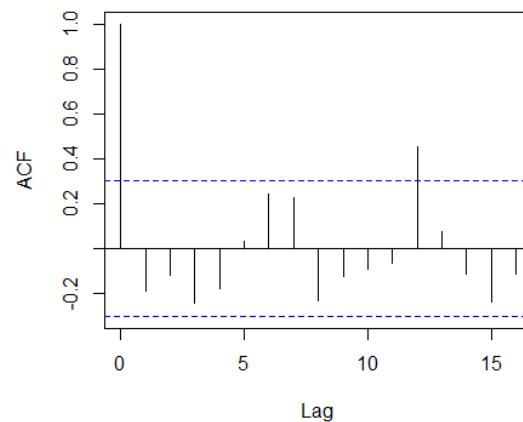
- Smoothing The time series for 42 months before Building Model Using Classical Decomposition

Model Building for Sales of APAC Consumer (Classical Decomposition)

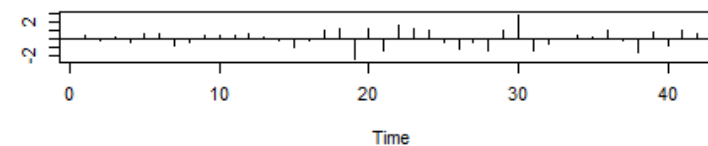
Global Predict for APAC Consumer Sales



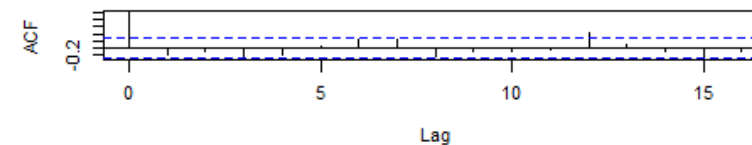
Series local_predict_APAC_Consumer_Sales



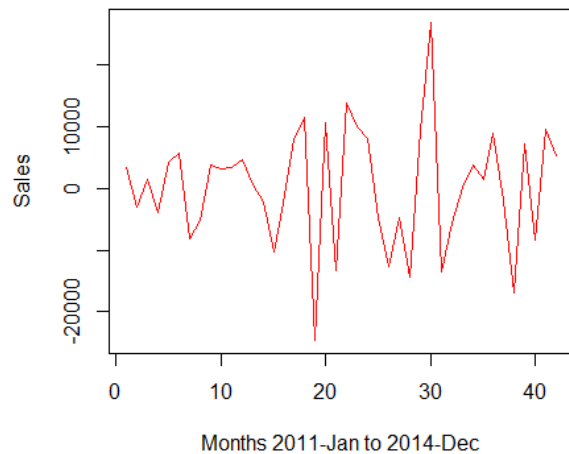
Standardized Residuals



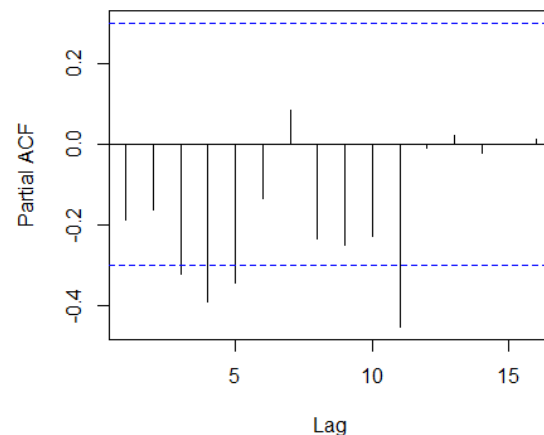
ACF of Residuals



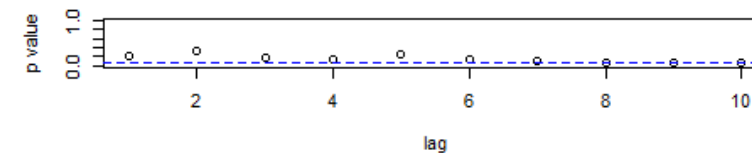
Local Predict for APAC Consumer Sales



Series local_predict_APAC_Consumer_Sales

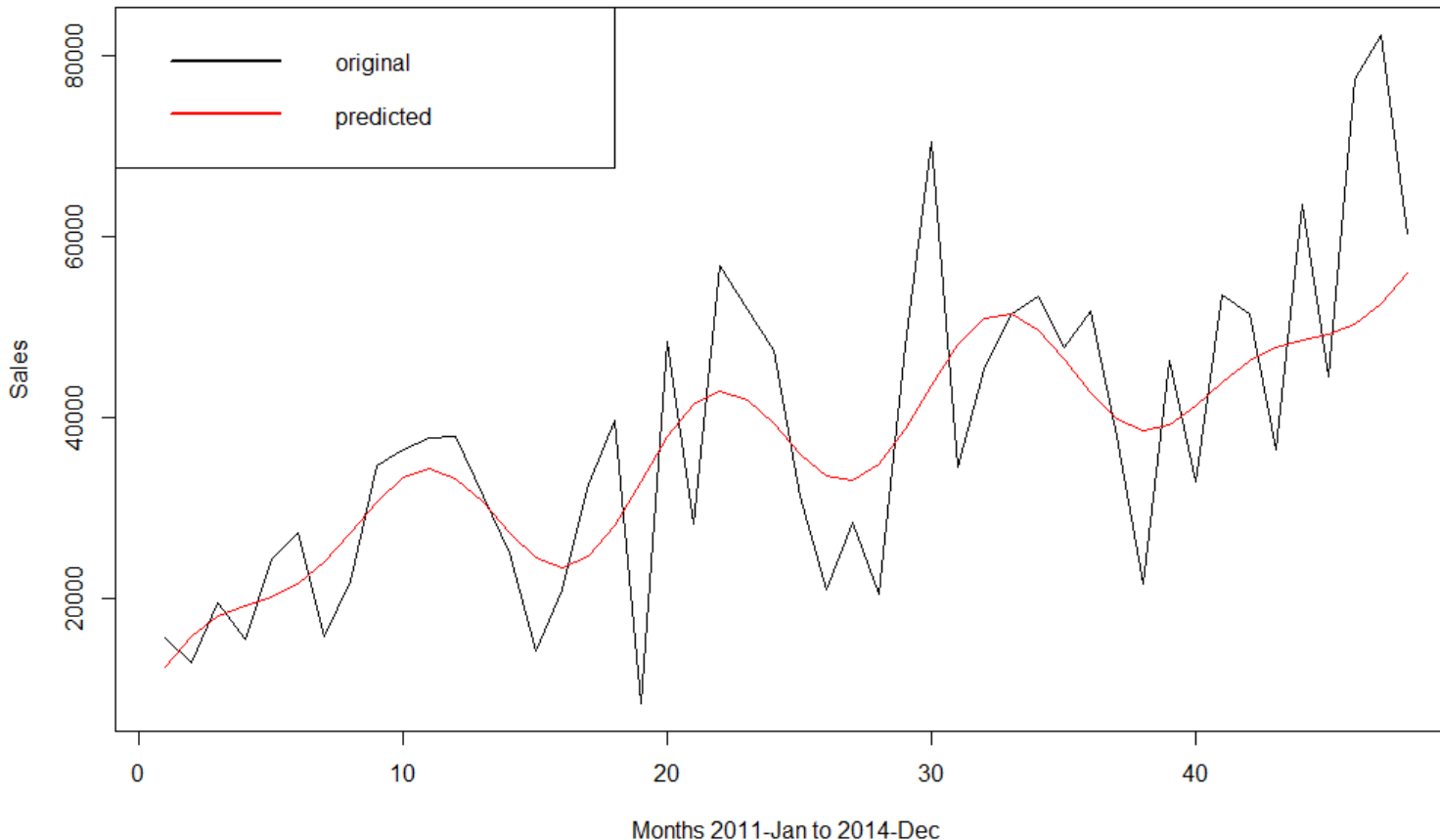


p values for Ljung-Box statistic



Model Evaluation for Sales of APAC Consumer (Classical Decomposition)

Global Mart Sales in APAC Market Consumer Segment from 2011-Jan to 2014-Dec

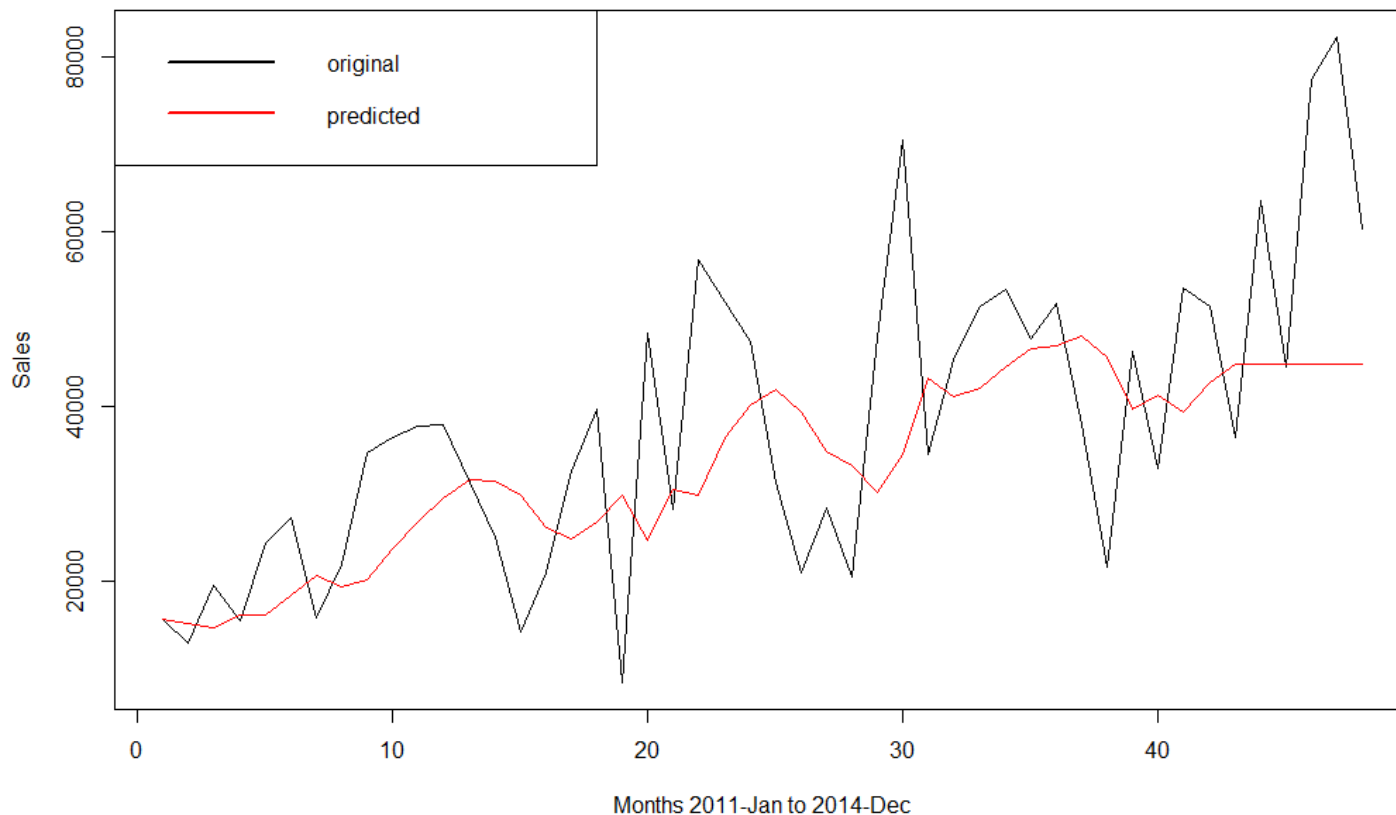


- MAPE = 23.8652
- ARIMA (0,0,0) with zero lag
- Log-Likelihood : -444.67
- AIC=891.33
- AICc=891.43
- BIC=893.07
- Residual Time series showed No white Noise
 ADF test p-value = 0.01
 KPSS Test p-value = 0.1

Observation : Sales is expected to increase for next 6 months

Model Building & Evaluation for Sales of APAC Consumer (Auto ARIMA)

Global Mart Sales in APAC Market Consumer Segment from 2011-Jan to 2014-Dec (Auto ARIMA)

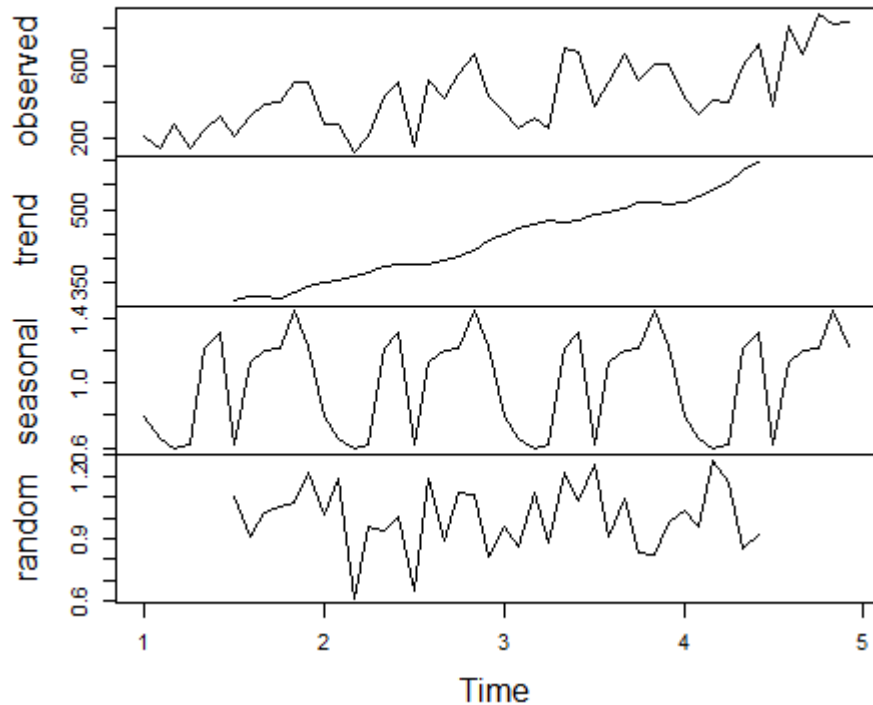


- MAPE = 27.689
- ARIMA (0,1,1)
- Log-Likelihood : -447.11
- AIC=898.23
- AICc=898.55
- BIC=901.66
- Residual Time series showed No white Noise
 - ADF test p-value = 0.01
 - KPSS Test p-value = 0.1

Observation : Sales is expected remain constant for next 6 months

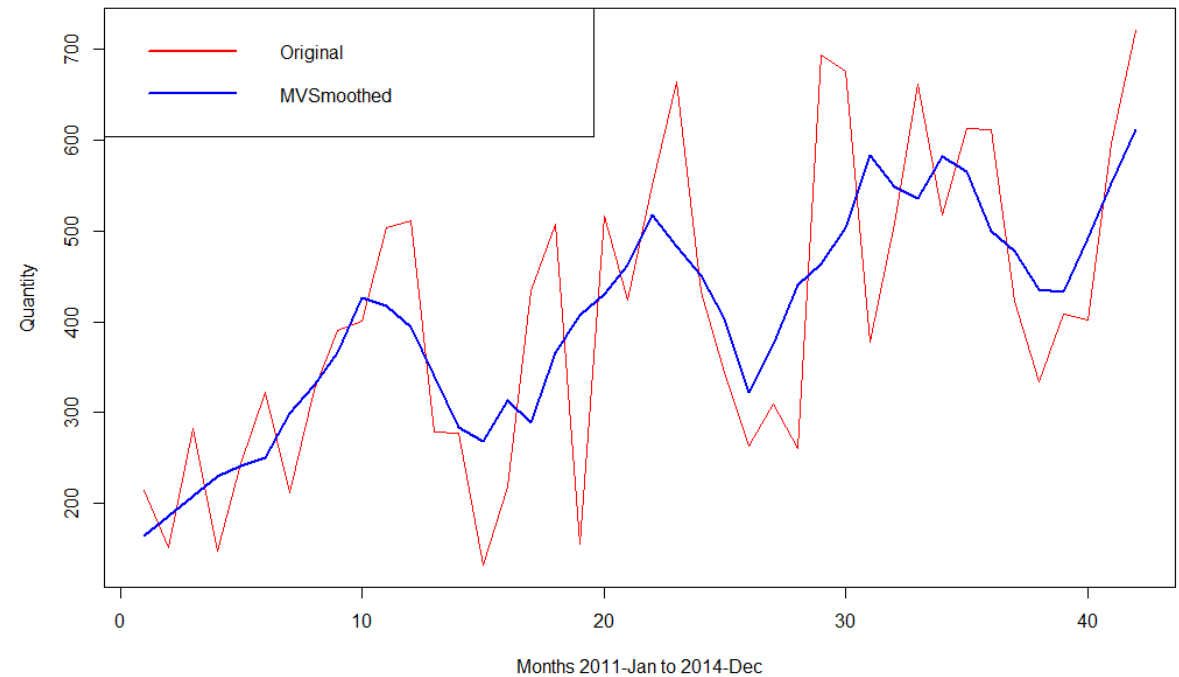
Analyzing Demand for APAC Consumer

Decomposition of multiplicative time series



- Demand for APAC Consumer during Jan-2011 to Dec-2014 show an increasing trend with a seasonality

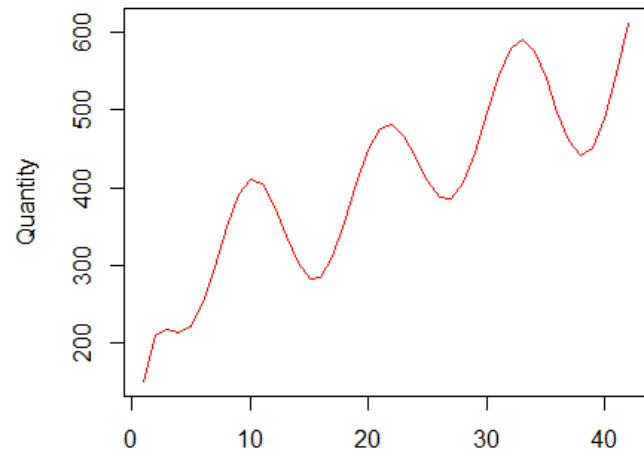
Global Mart Demand in APAC Market Consumer Segment from 2011-Jan to 2014-Dec



- Smoothing The time series for 42 months before Building Model Using Classical Decomposition

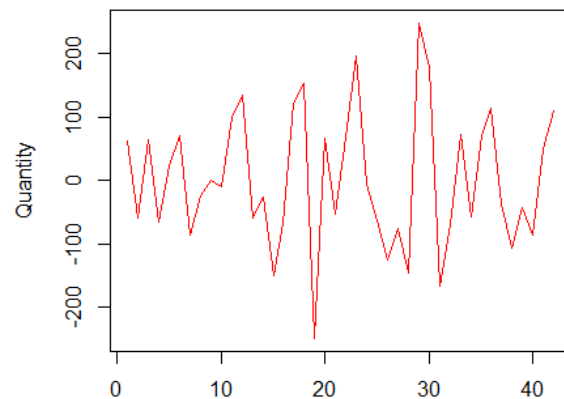
Model Building for Demand of APAC Consumer (Classical Decomposition)

Global Predict for APAC Consumer Demand

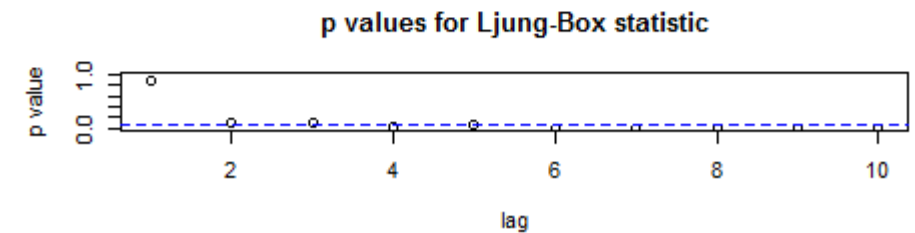
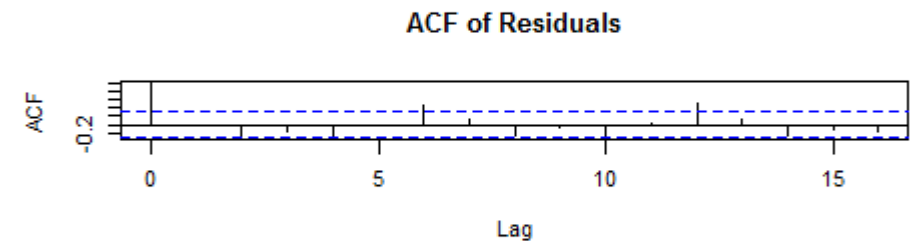
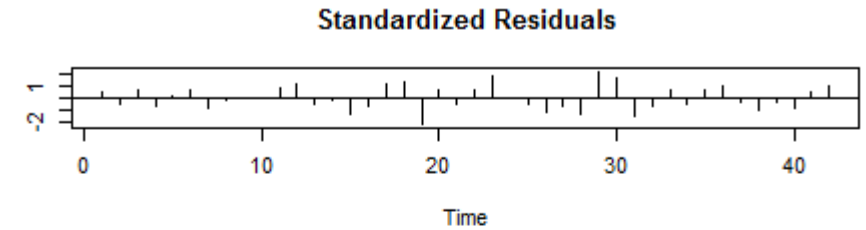
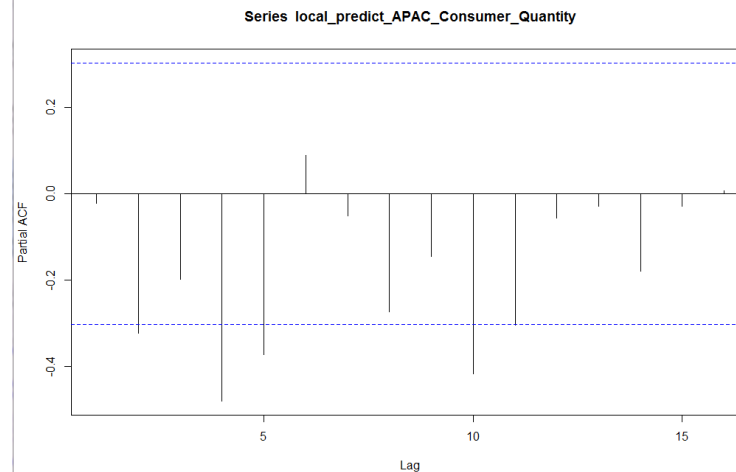
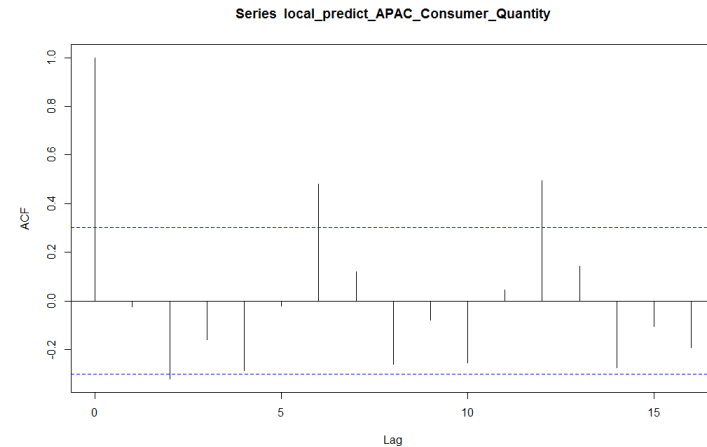


Months 2011-Jan to 2014-Dec

Local Predict for APAC Consumer Demand

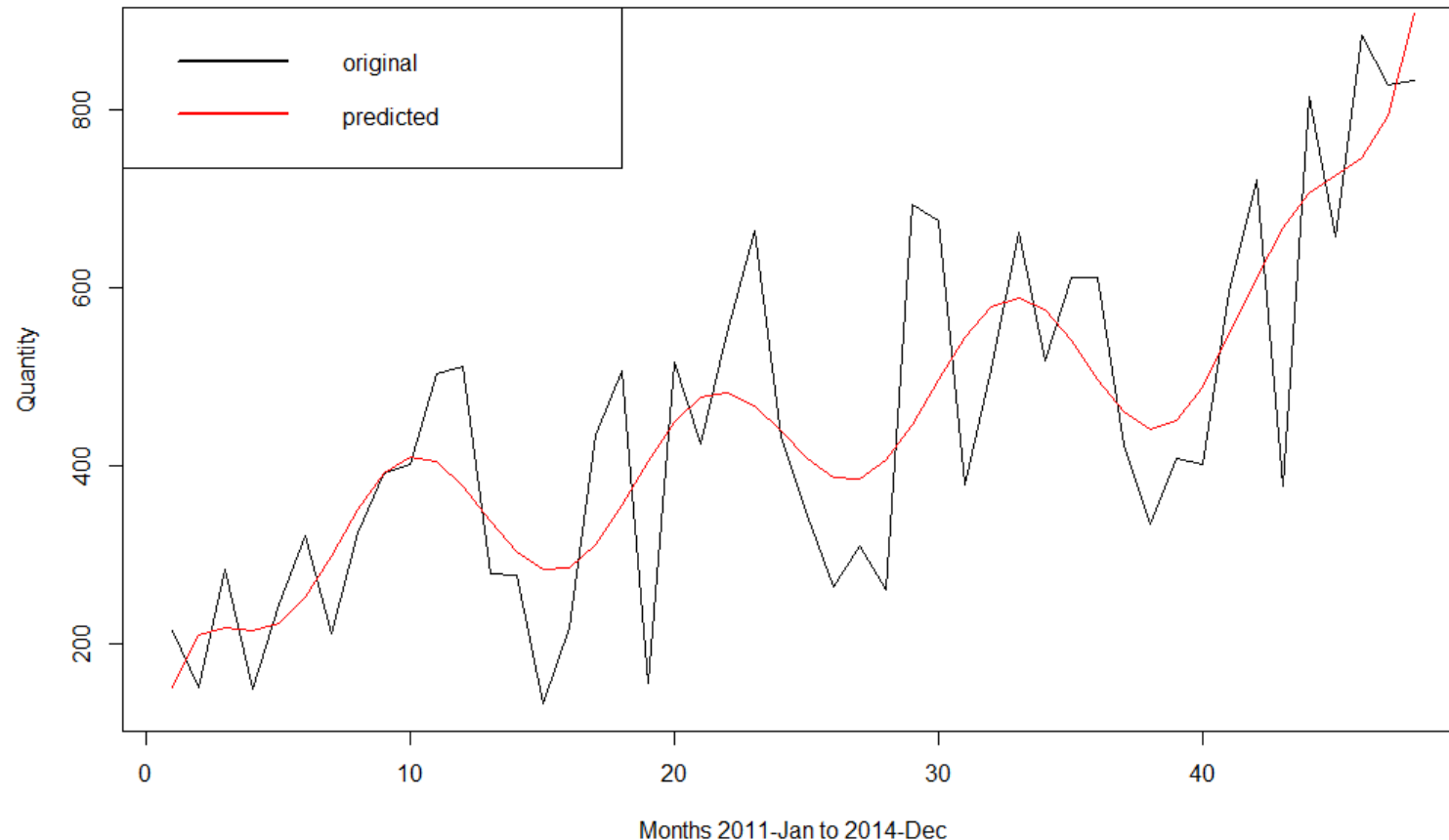


Months 2011-Jan to 2014-Dec



Model Evaluation for Demand of APAC Consumer (Classical Decomposition)

Global Mart Demand in APAC Market Consumer Segment from 2011-Jan to 2014-Dec

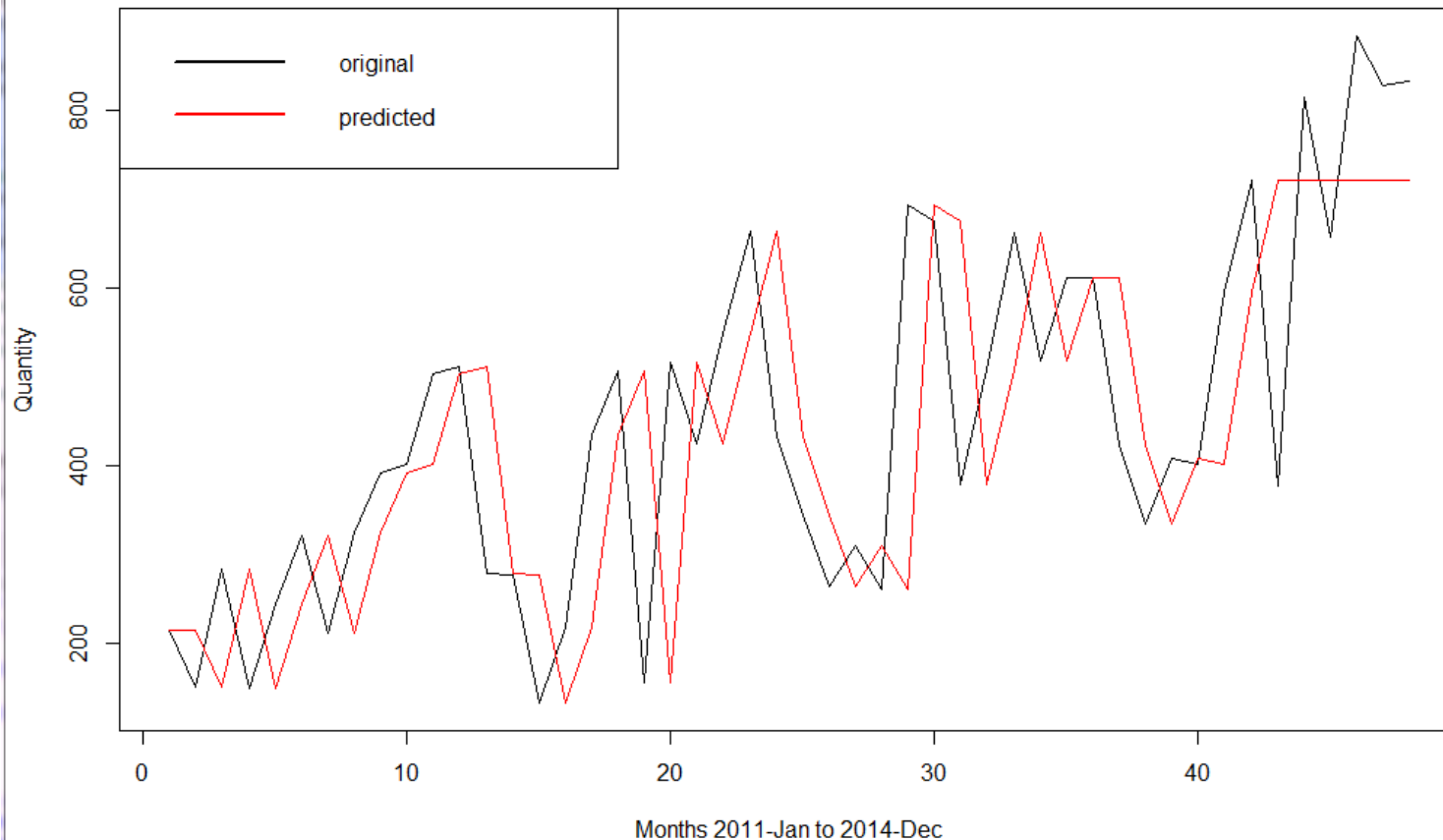


- MAPE = 21.719
- ARIMA (0,0,0) with zero lag
- Log-Likelihood : -255.63
- AIC=513.25
- AICc=513.35
- BIC=514.99
- Residual Time series showed No white Noise
 ADF test p-value = 0.01
 KPSS Test p-value = 0.1

Observation : Demand is expected to increase for next 6 months

Model Building & Evaluation for Demand of APAC Consumer (Auto ARIMA)

Global Mart Demand in APAC Market Consumer Segment from 2011-Jan to 2014-Dec (Auto ARIMA)

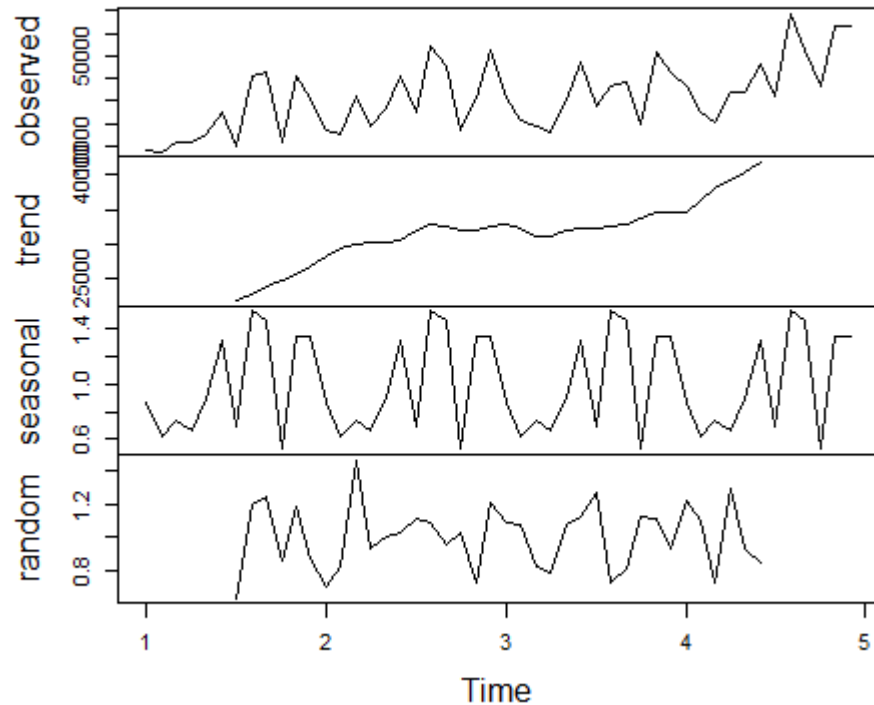


- MAPE = 26.244
- ARIMA (0,1,0)
- Log-Likelihood : -266.07
- AIC=534.14
- AICc=534.24
- BIC=535.85
- Residual Time series showed No white Noise
ADF test p-value = 0.01
KPSS Test p-value = 0.1

Observation : Demand is expected to remain constant for next 6 months

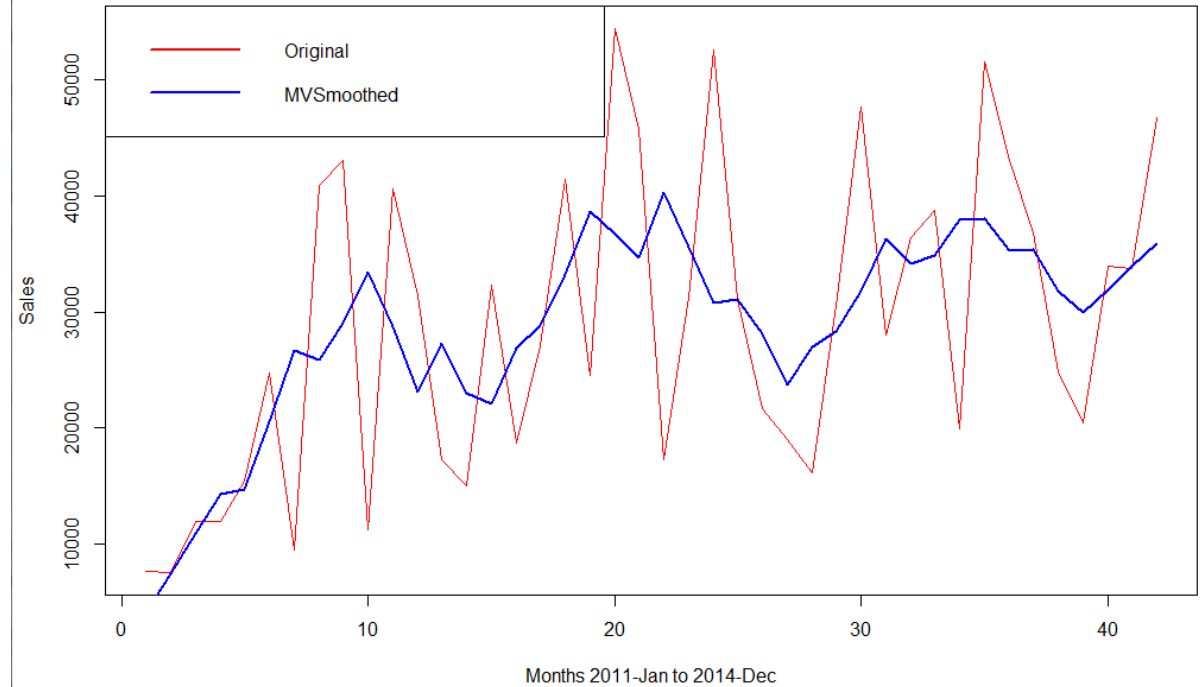
Analyzing Sales for EU Consumer

Decomposition of multiplicative time series



- Sales for EU Consumer during Jan-2011 to Dec-2014 show an increasing trend with a seasonality

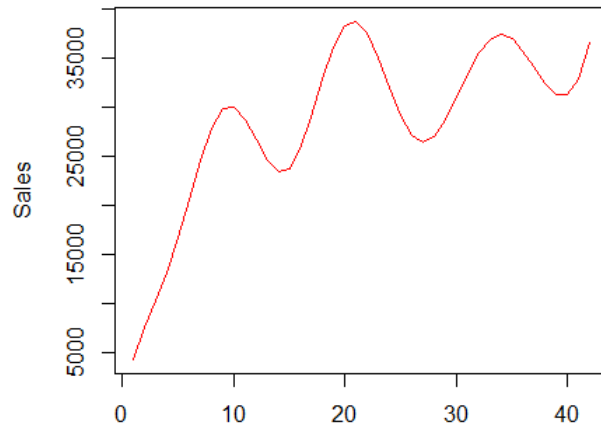
Global Mart Sales in EU Market Consumer Segment from 2011-Jan to 2014-Dec



- Smoothing The time series for 42 months before Building Model Using Classical Decomposition

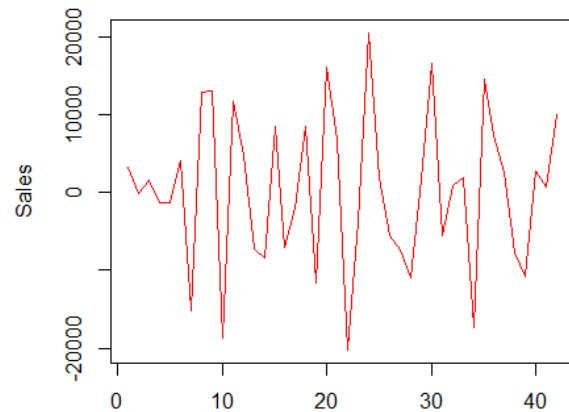
Model Building for Sales of EU Consumer (Classical Decomposition)

Global Predict for EU Consumer Sales



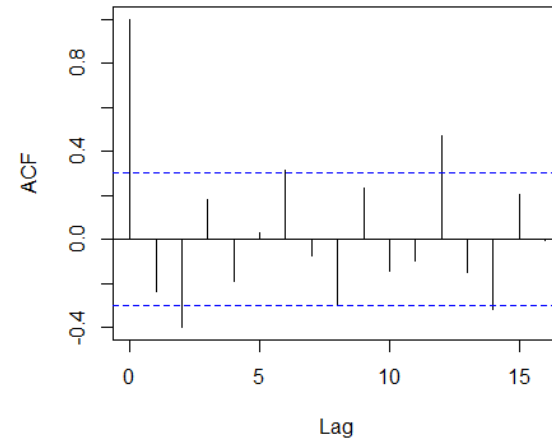
Months 2011-Jan to 2014-Dec

Local Predict for EU Consumer Sales

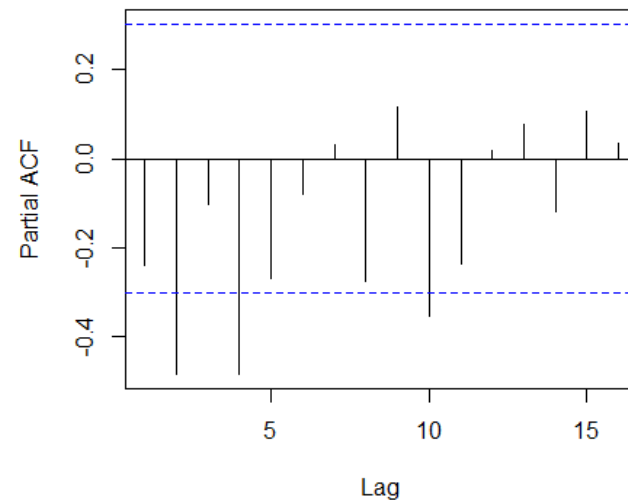


Months 2011-Jan to 2014-Dec

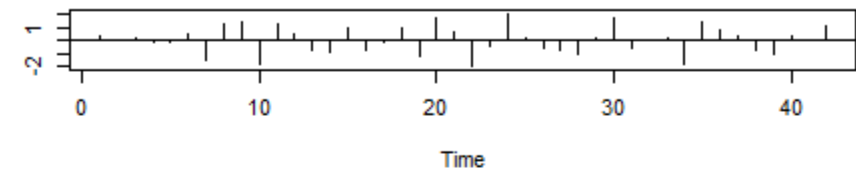
Series local_predict_EU_Consumer_Sales



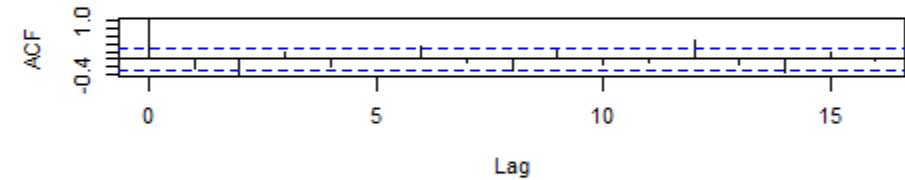
Series local_predict_EU_Consumer_Sales



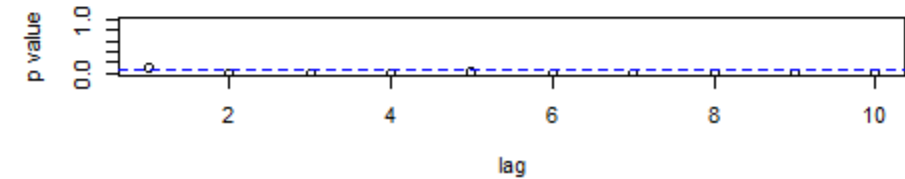
Standardized Residuals



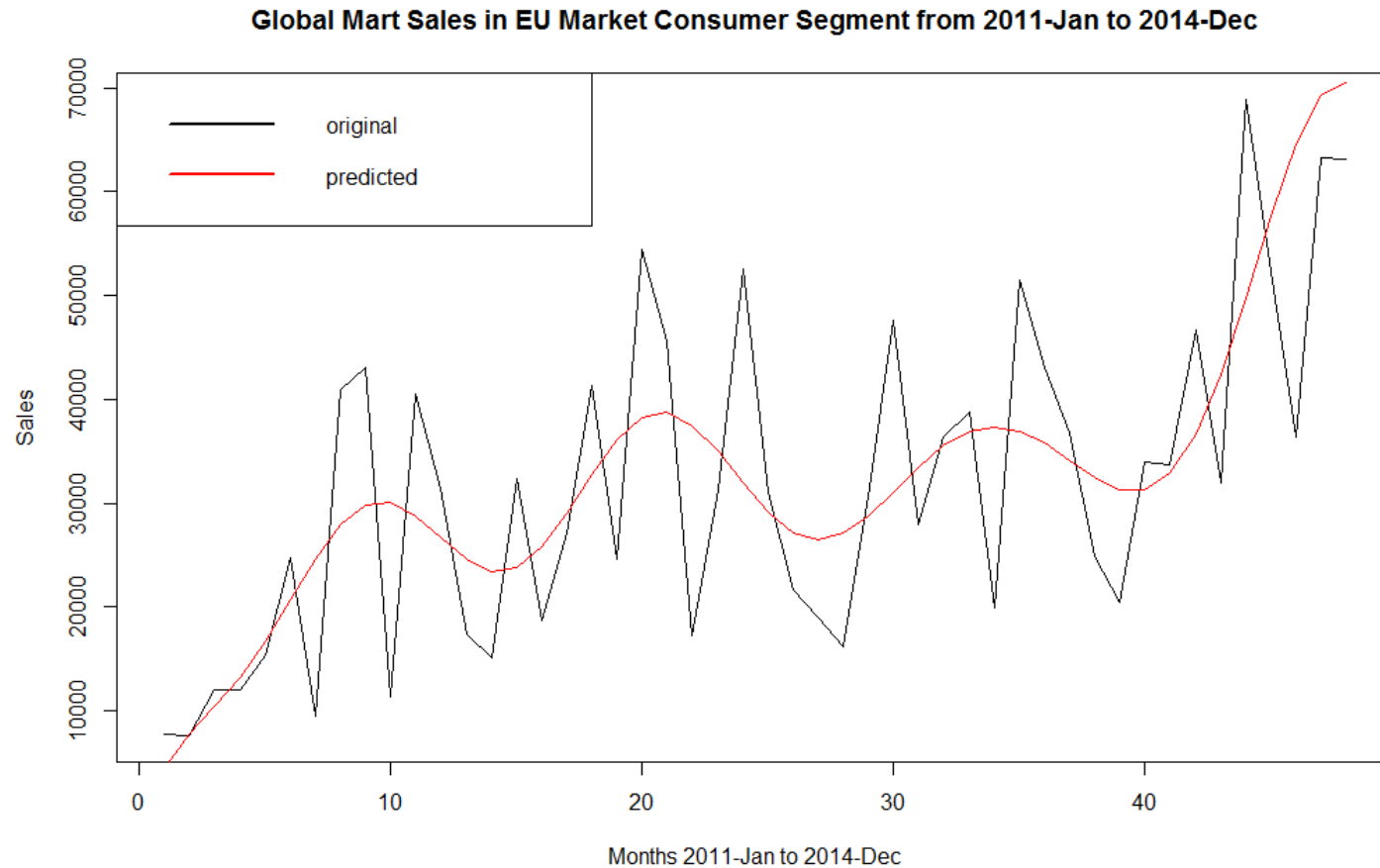
ACF of Residuals



p values for Ljung-Box statistic



Model Evaluation for Sales of EU Consumer (Classical Decomposition)

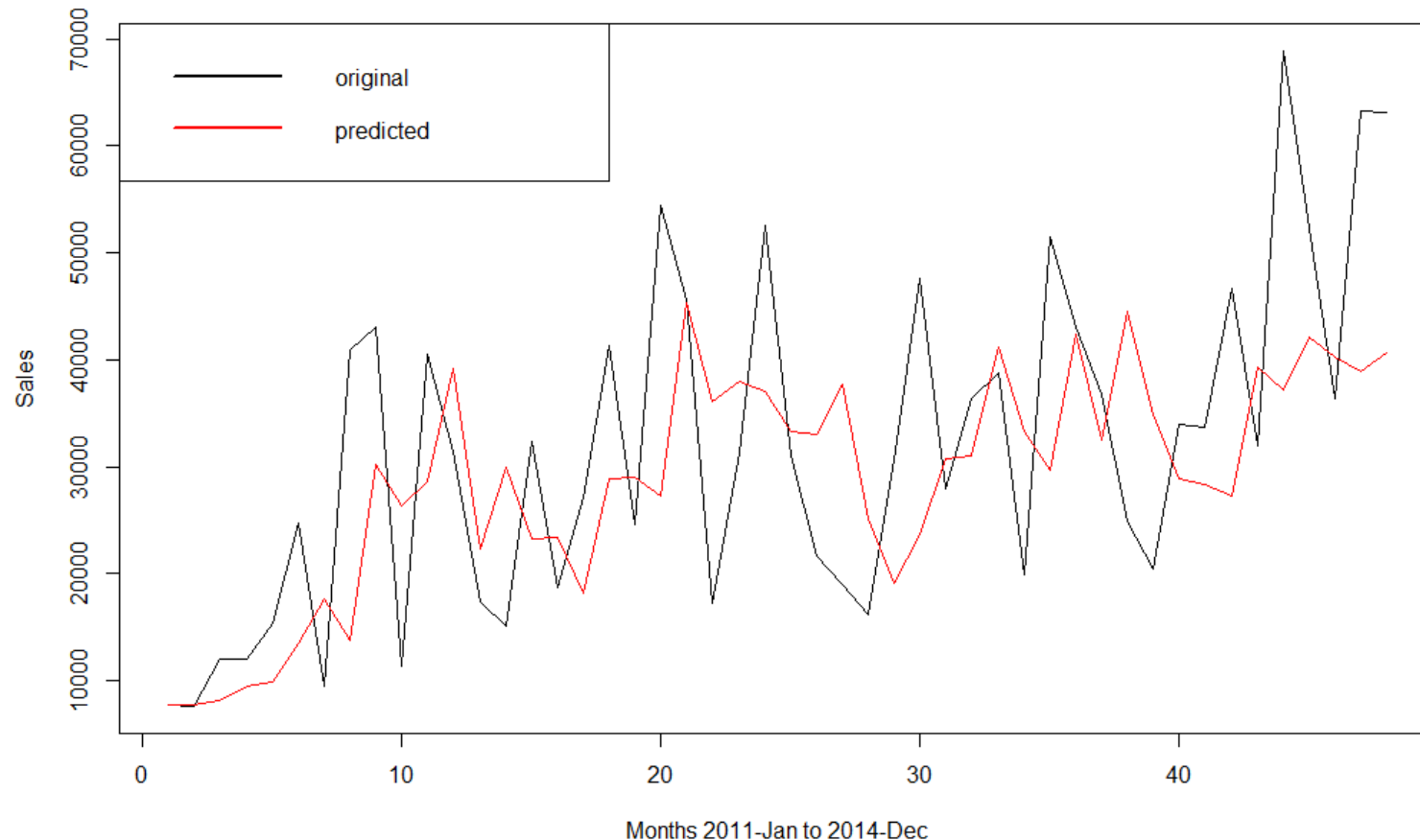


- MAPE = 28.274
- ARIMA (0,0,0) with zero mean
- Log-Likelihood : -445.98
- AIC=893.96
- AICc=894.06
- BIC=895.7
- Residual Time series showed No white Noise
ADF test p-value = 0.01
KPSS Test p-value = 0.1

Observation : Sales is expected to increase for next 6 months

Model Building & Evaluation for Sales of EU Consumer (Auto ARIMA)

Global Mart Sales in EU Market Consumer Segment from 2011-Jan to 2014-Dec (Auto ARIMA)

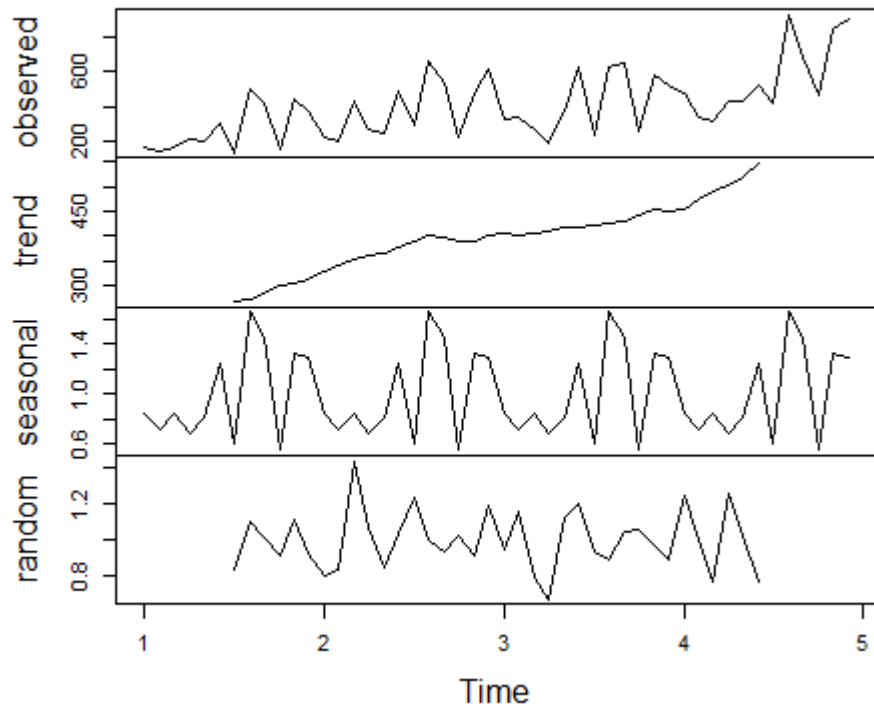


- MAPE = 28.926
- ARIMA (2,1,0)
- Log-Likelihood : -445.84
- AIC=897.67
- AICc=898.32
- BIC=902.81
- Residual Time series showed No white Noise
 ADF test p-value = 0.01
 KPSS Test p-value = 0.1

Observation : Sales is expected to increase for next 6 months

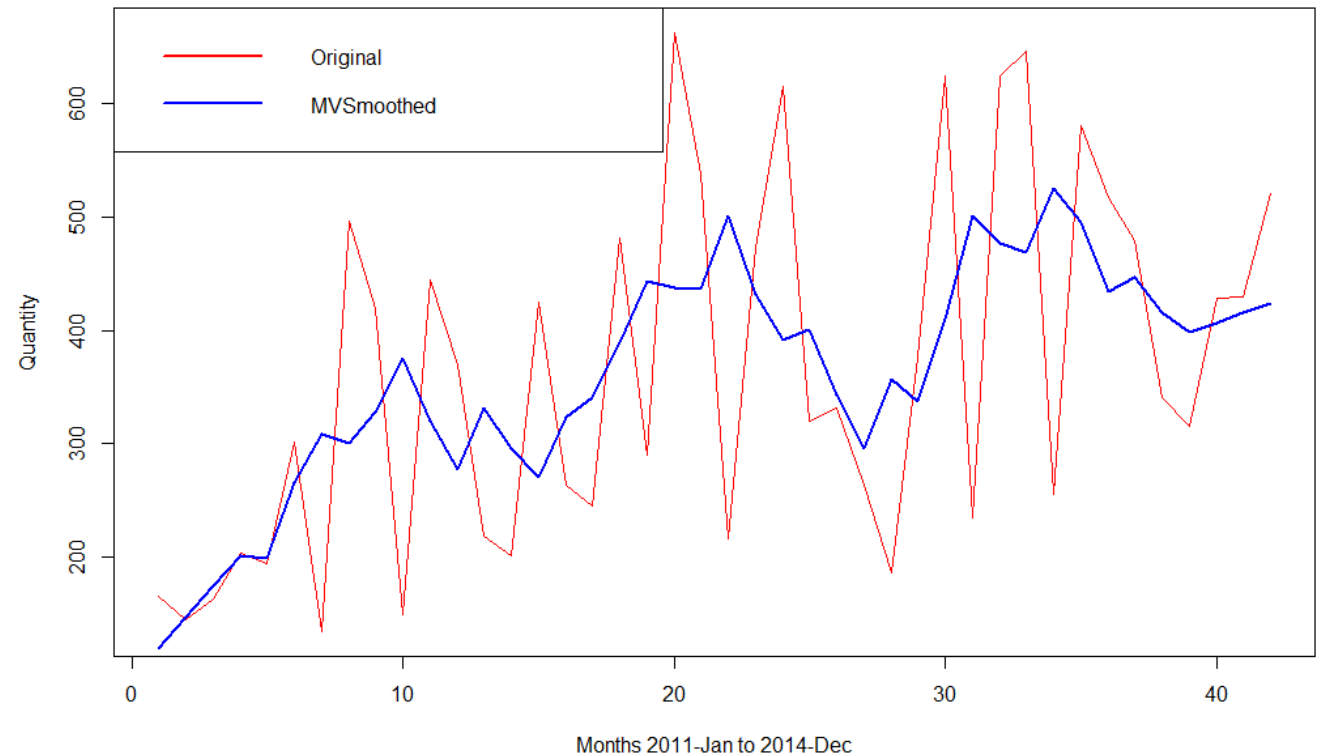
Analyzing Demand for EU Consumer

Decomposition of multiplicative time series



- Demand for APAC Consumer during Jan-2011 to Dec-2014 show an increasing trend with a seasonality

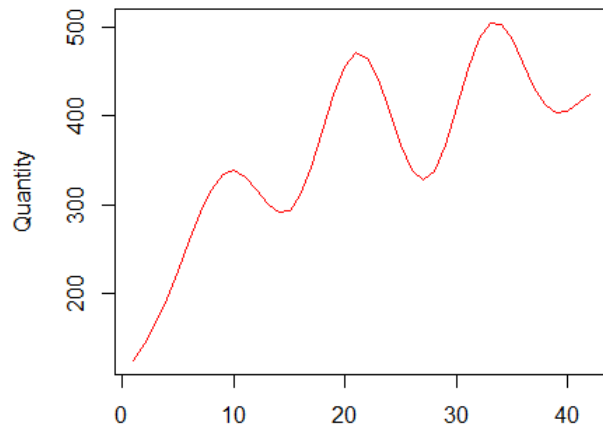
Global Mart Demand in EU Market Consumer Segment from 2011-Jan to 2014-Dec



- Smoothing The time series for 42 months before Building Model Using Classical Decomposition

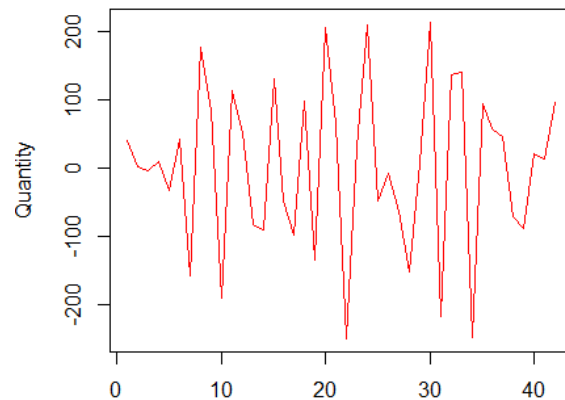
Model Building for Demand of EU Consumer (Classical Decomposition)

Global Predict for EU Consumer Demand



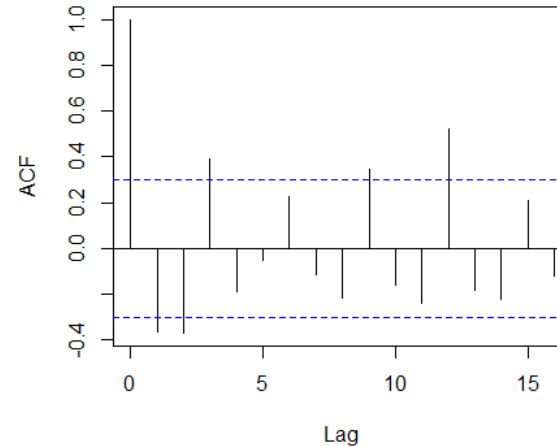
Months 2011-Jan to 2014-Dec

Local Predict for EU Consumer Demand

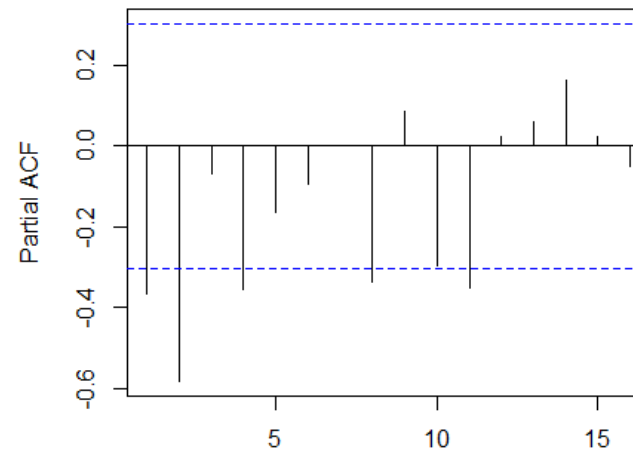


Months 2011-Jan to 2014-Dec

Series local_predict_EU_Consumer_Quantity

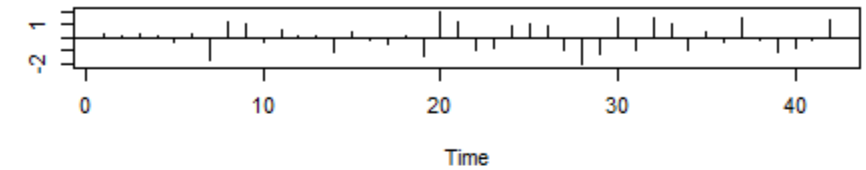


Series local_predict_EU_Consumer_Quantity

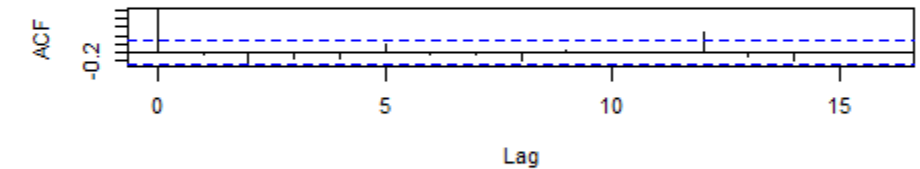


Lag

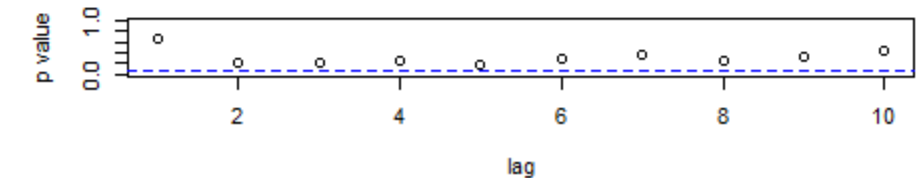
Standardized Residuals



ACF of Residuals

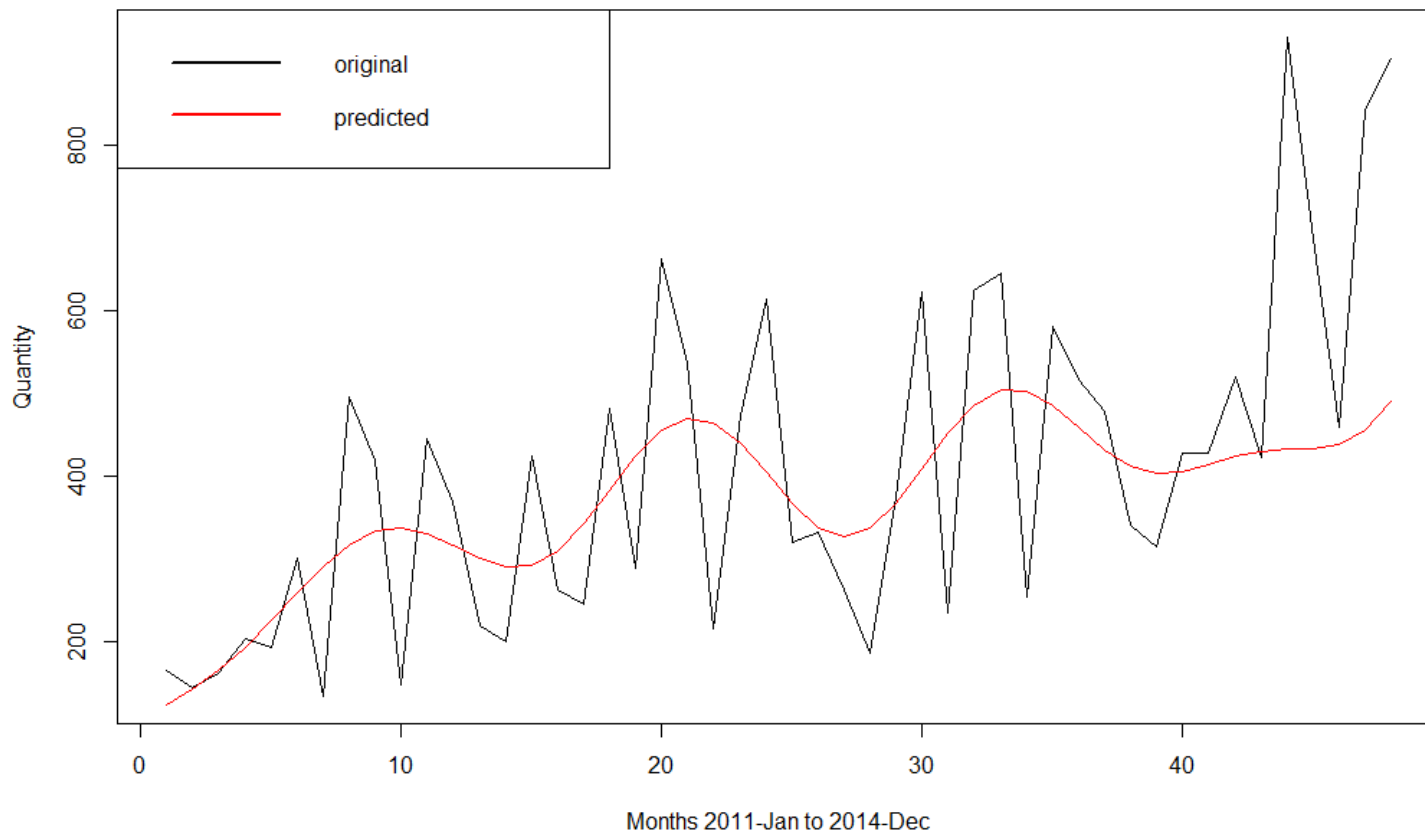


p values for Ljung-Box statistic



Model Evaluation for Demand of EU Consumer (Classical Decomposition)

Global Mart Demand in EU Market Consumer Segment from 2011-Jan to 2014-Dec

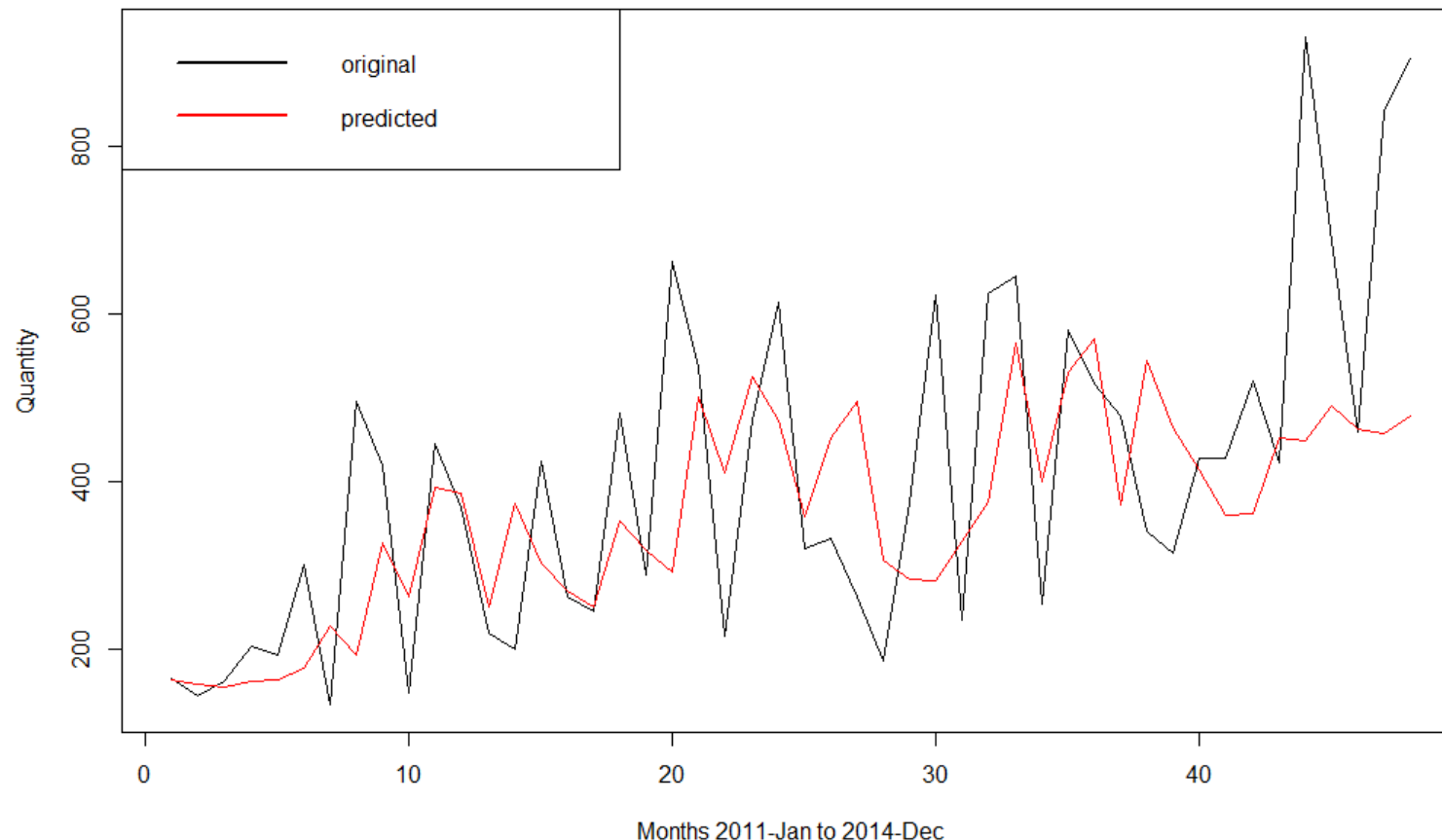


- MAPE = 31.398
- ARIMA (2,0,0) with zero mean
- Log-Likelihood : -249.06
- AIC=504.12
- AICc=504.75
- BIC=509.33
- Residual Time series showed No white Noise
 ADF test p-value = 0.01
 KPSS Test p-value = 0.1

Observation : Demand is expected to increase for next 6 months

Model Building & Evaluation for Demand of EU Consumer (Auto ARIMA)

Global Mart Demand in EU Market Consumer Segment from 2011-Jan to 2014-Dec (Auto ARIMA)



- MAPE = 30.133
- ARIMA (2,1,0)
- Log-Likelihood : -261.9
- AIC=529.8
- AICc=534.44
- BIC=534.94
- Residual Time series showed No white Noise
 ADF test p-value = 0.01
 KPSS Test p-value = 0.1

Observation : Demand is expected to increase for next 6 months

Conclusions

- Top 2 profitable and Consistent Markets-Segments are APAC Consumer and EU Consumer
- Sales for APAC Consumer and EU Consumer for the period between 2011-Jan to 2014-Jun shows increasing trend.
- Quantity of products sold for APAC Consumer and EU Consumer for the period between 2011-Jan to 2014-Jun shows increasing trend.
- As per Classical decomposition Time series Model with Good Accuracy
 - Sales and Demand for APAC Consumer is expected to increase in next 6 Months (2014-Jul – 2014 Dec).
 - Sales and Demand for EU Consumer is expected to increase in next 6 Months (2014-Jul – 2014 Dec).
- As per Auto ARIMA Time series Model with Good Accuracy
 - Sales and Demand for APAC Consumer is expected to remain constant in next 6 Months (2014-Jul – 2014 Dec).
 - Sales and Demand for EU Consumer is expected to increase in next 6 Months (2014-Jul – 2014 Dec).

Recommendations

- It is Highly recommended to update inventory for APAC market Consumer Segment as the Demand and Sales is expected to increase or remain stable in next 6 months. Hence Marketing team may be summoned if more focused marketing strategy is required.
- It is Highly recommended to update inventory for EU market Consumer Segment as the Demand and Sales is expected to increase in next 6 months.

Thank You!