Retail- Giant Sales Forecasting

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Background : Retail – Giant Forecasting

Background :

- “Global Mart” is an online store super giant having worldwide operations.
- Deals with all the major product categories – Consumer, corporate & home office.

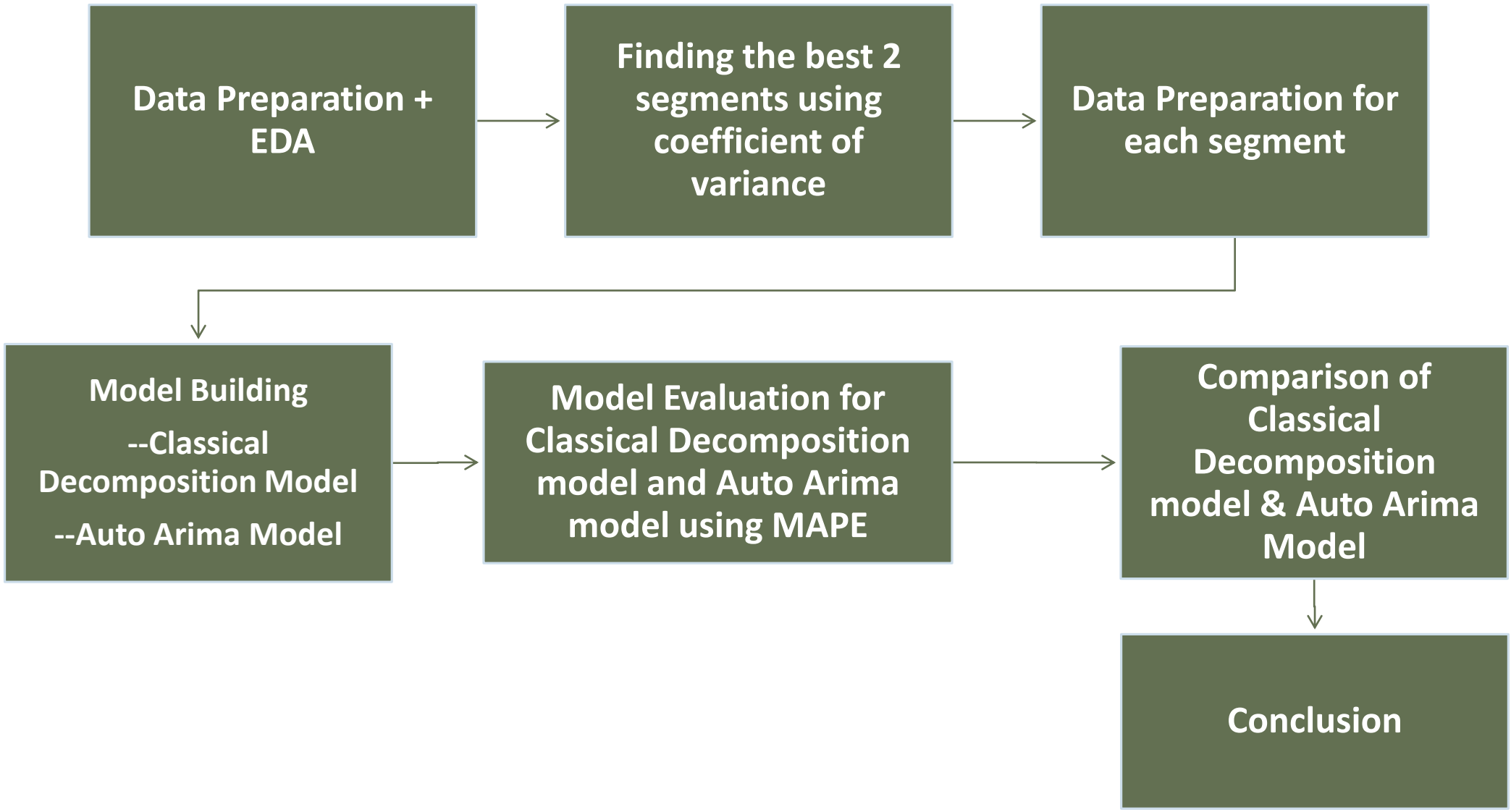
Business Objective :

- To Forecast the sales and the demand for the next 6 months, that would help the sales/operation manager of Global Mart to manage the revenue and inventory accordingly.

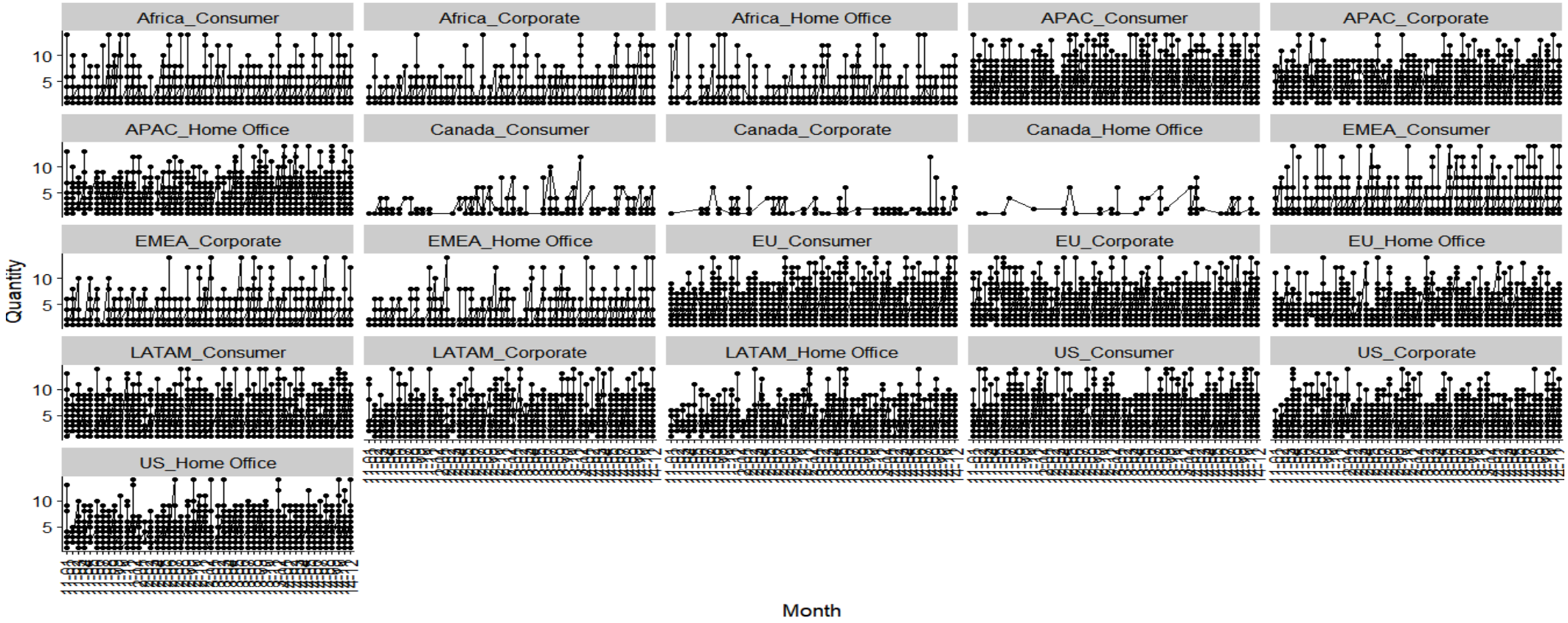
Data understanding

- Given data is at the transactional level, with each row representing unique order made on the online store.
- Total number of attributes : 24
- Important variables for analysis : Segment, Market, Sales, Quantity, Profit, Order Date

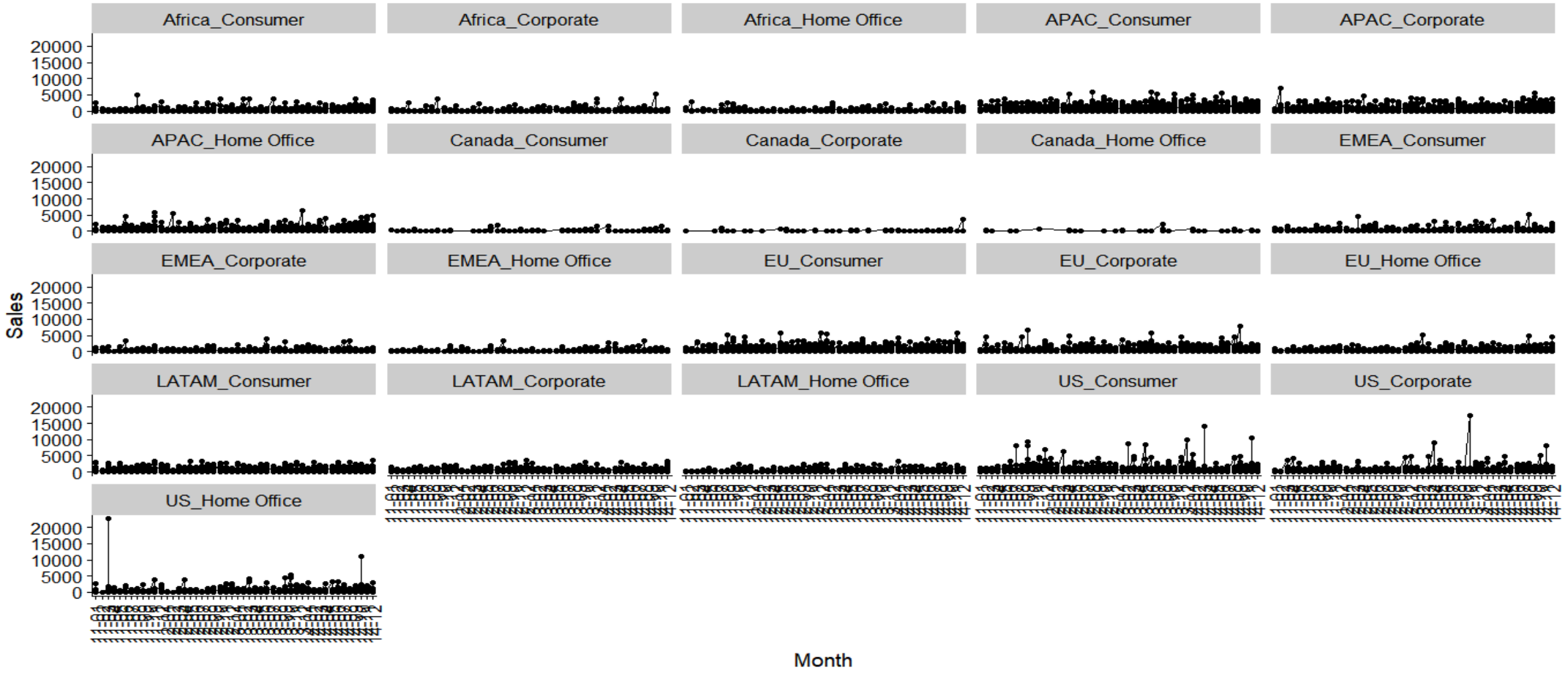
Strategy : Flow Chart



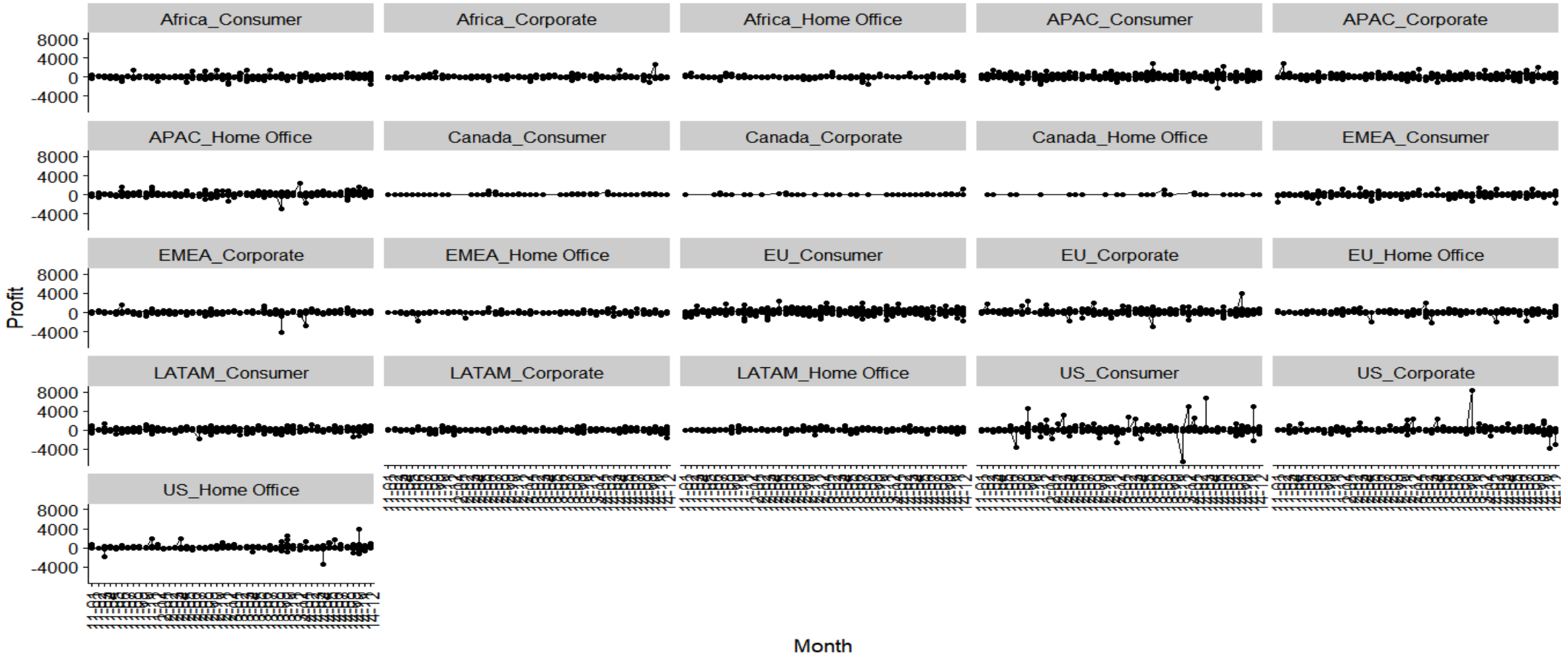
EDA : Plots of Monthly Quantity for all 21 segments



EDA : Plots of Monthly Sales for all 21 segments



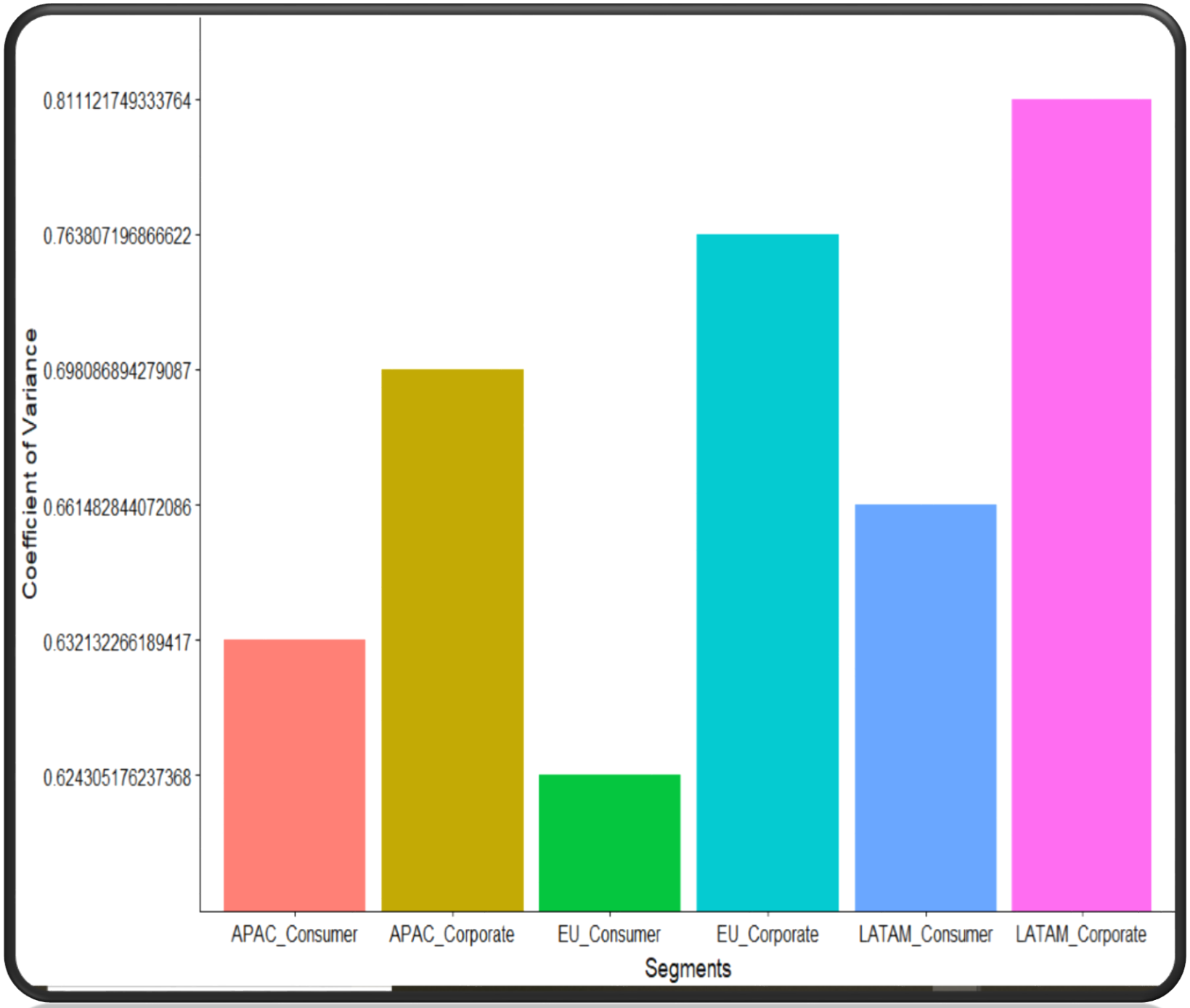
EDA : Plots of Monthly Profit for all 21 segments



Important Market Segments

- Best segments calculated using the Principle of ‘Coefficient of Variance’ : Lower the ratio of standard deviation to mean, better is the outcome.
- Bar Graph plotted shows the result obtained after calculating coefficient of variance for top 6 market segments(having lower COV value)
- It clearly depicts Top 2 best market segments with the lowest coefficient of variance :

1) EU_Consumer
2) APAC_Consumer



Time Series Analysis : Segment : EU_Consumer

Time Series Analysis : EU_Consumer (Sales)

Step : 1: Fig.(a) represents original time series ,smoothed series & model line after modelling trend and seasonality

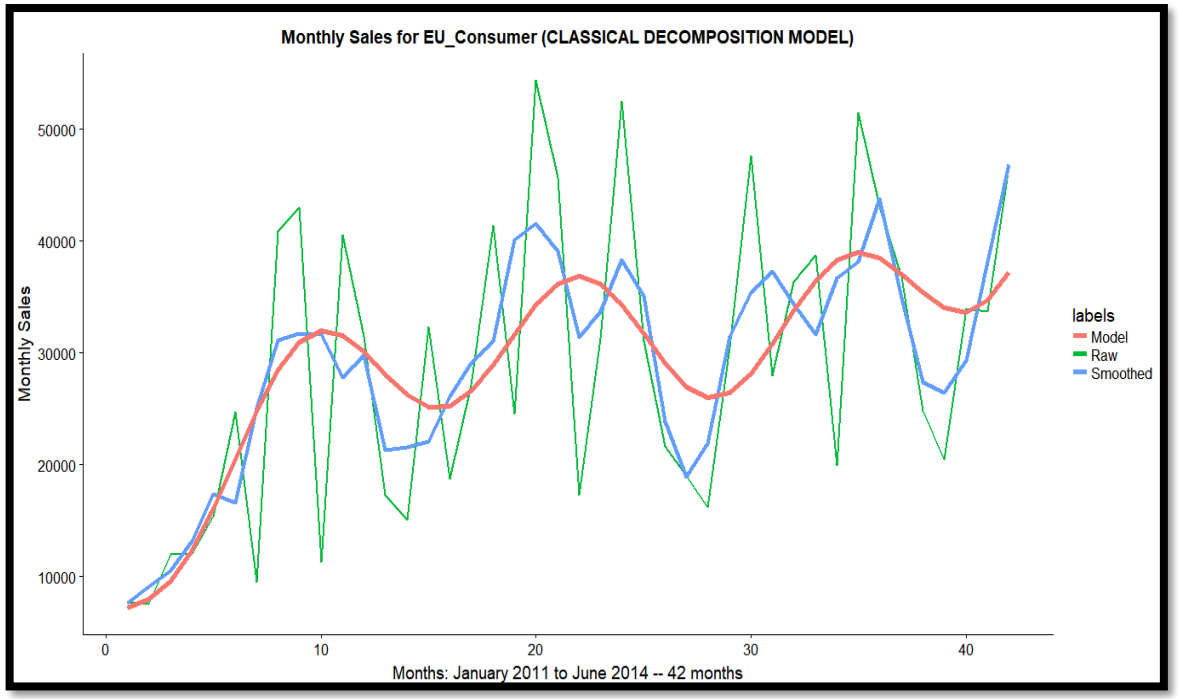


Fig.(a)

Step :2 : Locally predictable series(Fig:d) can be obtained by removing Trend and seasonality(Fig:c) from the original time series(Fig:b)

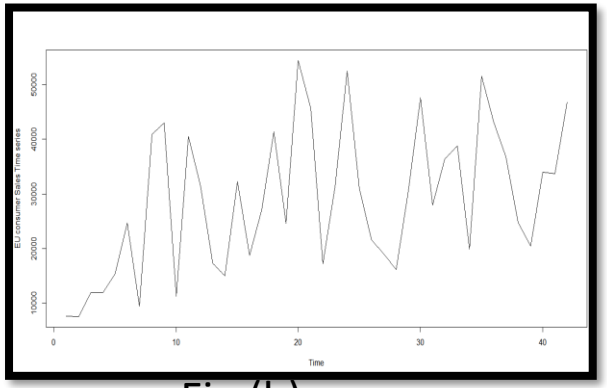


Fig.(b)

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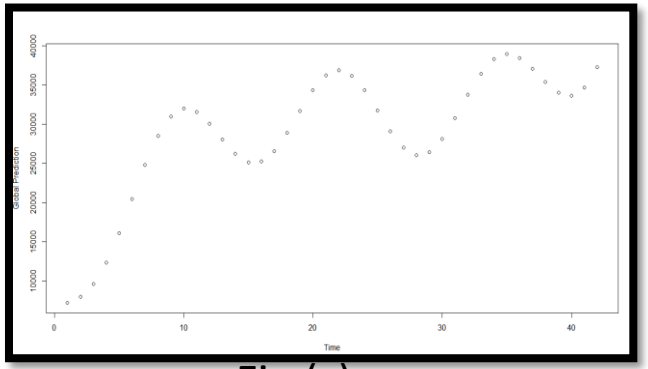


Fig.(c)

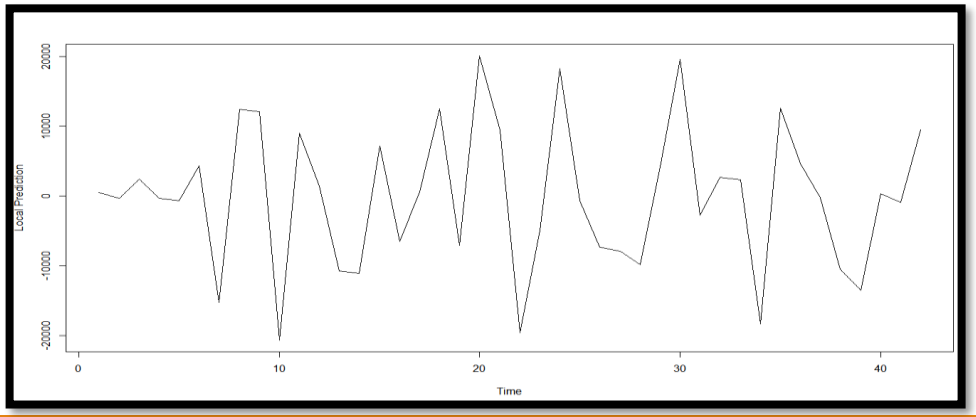
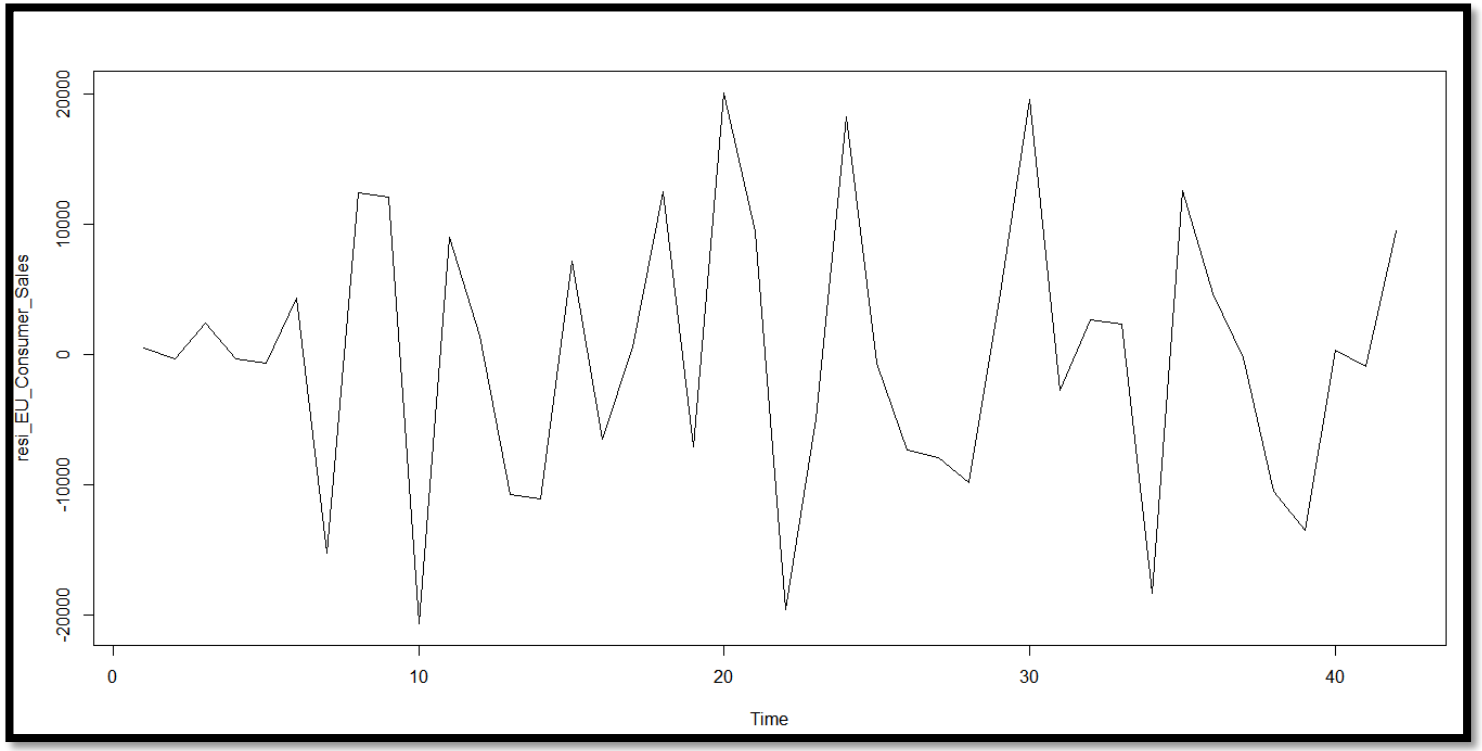


Fig.(d)

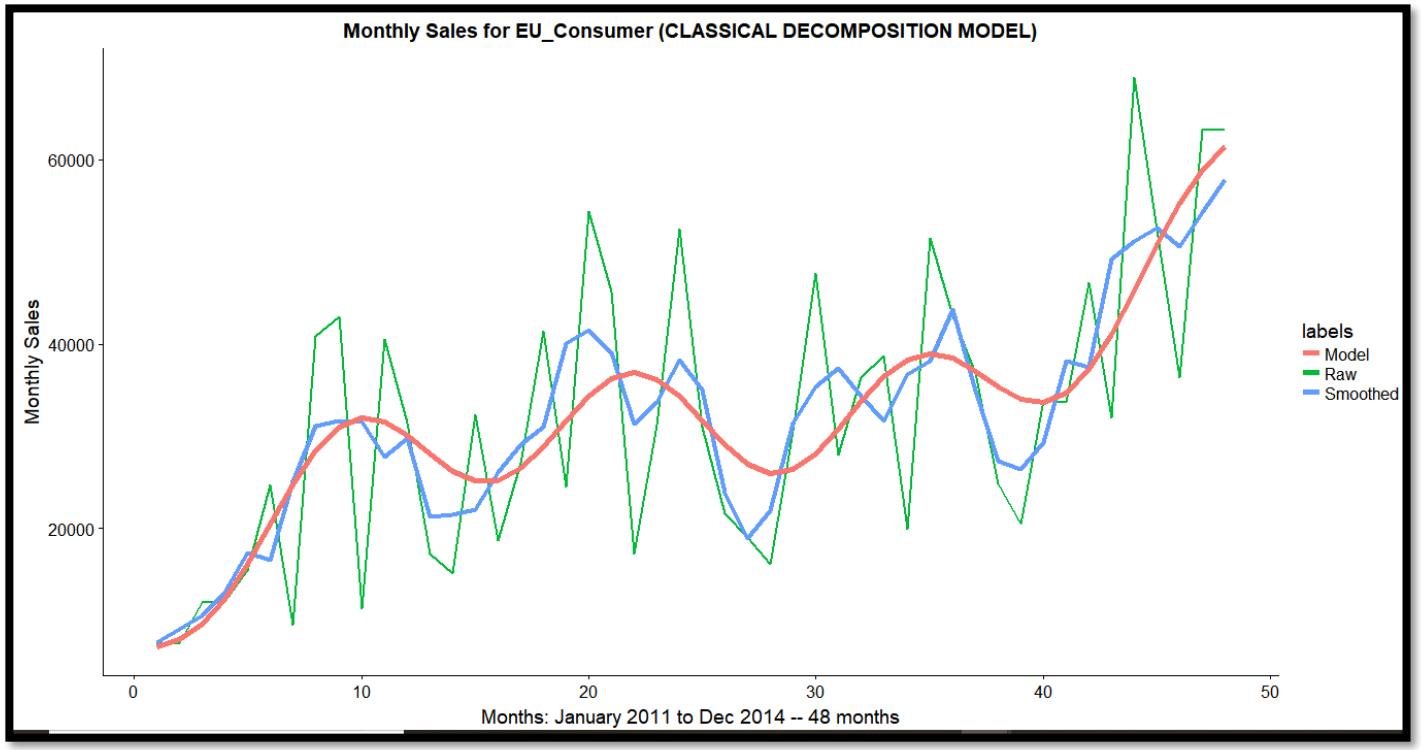
Time Series Analysis : EU_Consumer (Sales)

Step 3: After applying auto.arima() on the local prediction, next step is to check if the remaining residual obtained is white noise. Following is the graph obtained for residual:



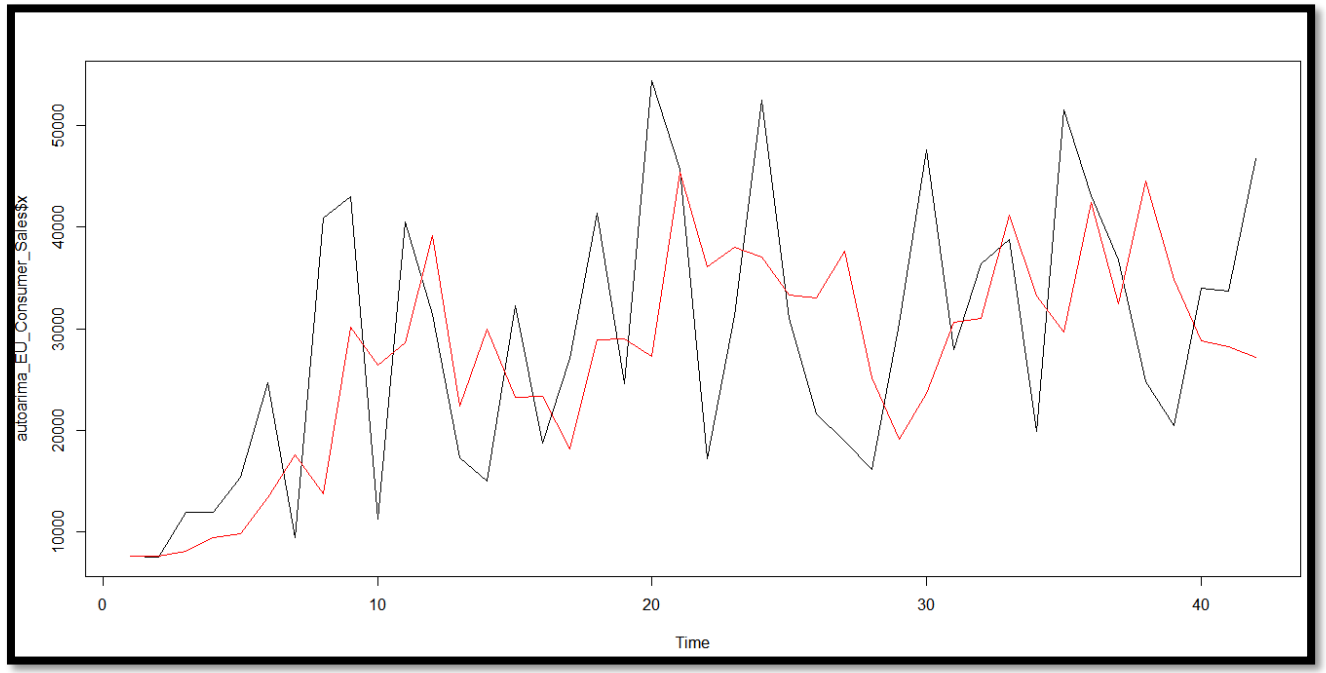
Step 4: adf test with pvalue = 0.01 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

Evaluating the Classical Decomposition model using MAPE : EU_Consumer (Sales)



- After forecasting the sales value for last 6 months using the model created, we get MAPE = 21% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

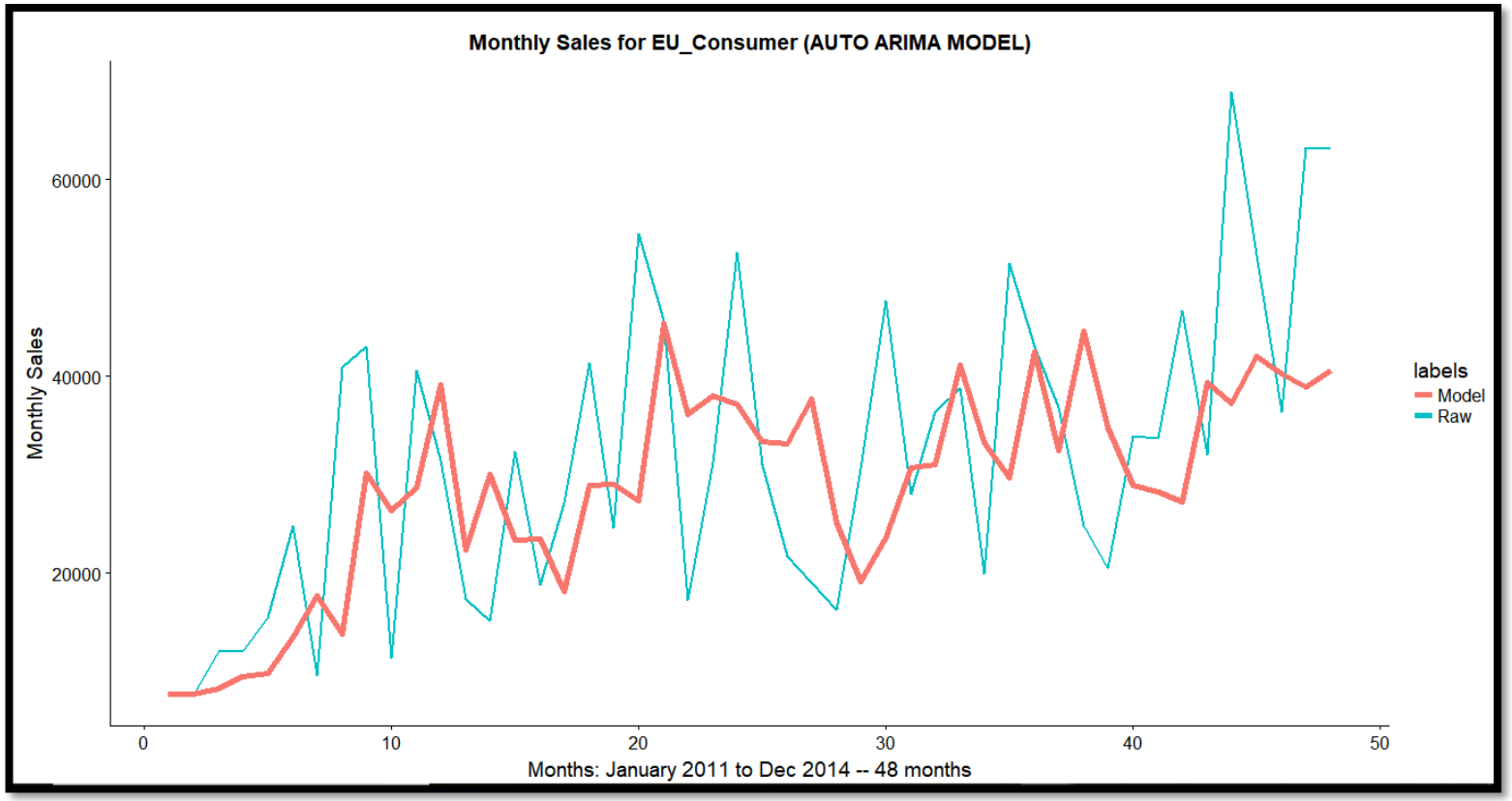
Model Building - Auto Arima : EU_Consumer (Sales)



- Graph shows the model obtained using Auto Arima method.
- On checking if the residual is noise we get the following result:

  adf test with pvalue = 0.01 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

Evaluating the Auto Arima model using MAPE : EU_Consumer(Sales)

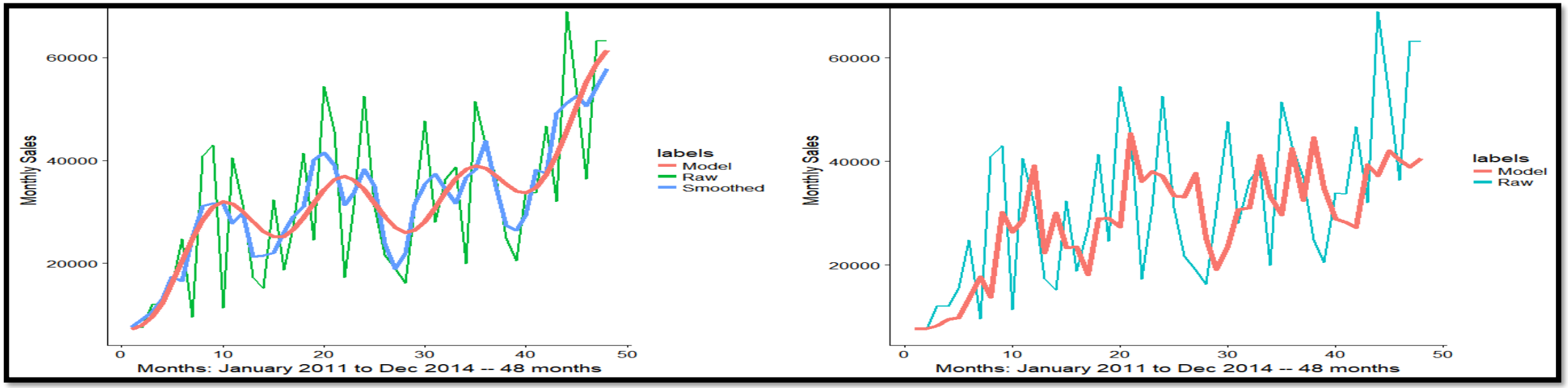


- After forecasting the sales value for last 6 months using the model created, we get MAPE = 28% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

COMPARING CLASSICAL DECOMPOSITION MODEL AND AUTO ARIMA MODEL : EU_Consumer(Sales)

CLASSICAL DECOMPOSITION MODEL MAPE : 21%

AUTO ARIMA MODEL MAPE : 28%



Through Graphs as well as MAPE Values, we can conclude that the model prepared manually through classical decomposition will lead to better forecasts for this particular market_segment.

Time Series Analysis : EU_Consumer (Quantity)

Step : 1: Fig.(a) represents original time series ,smoothed series & model line after modelling trend and seasonality

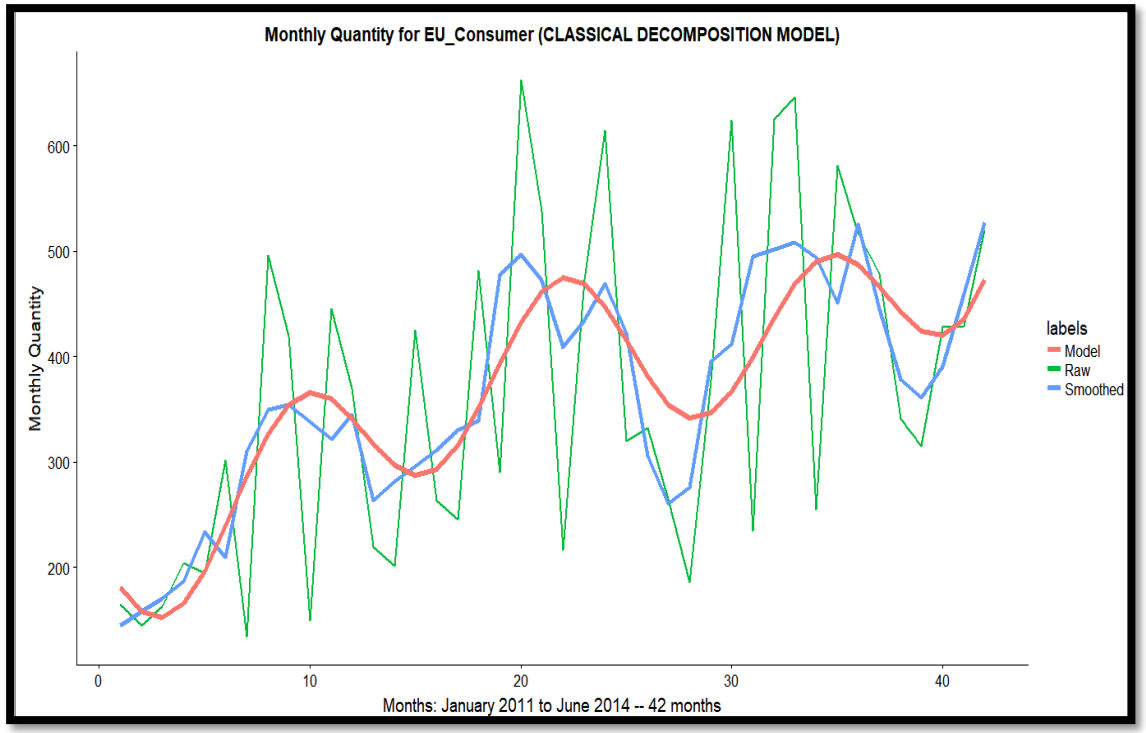


Fig.(a)

Step :2 : Locally predictable series(Fig:d) can be obtained by removing Trend and seasonality(Fig:c) from the original time series(Fig:b)

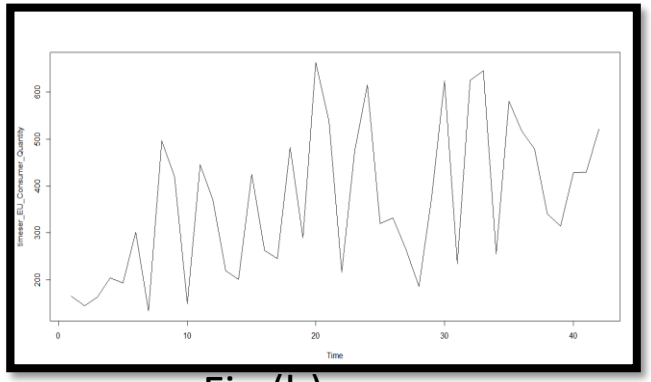


Fig.(b)

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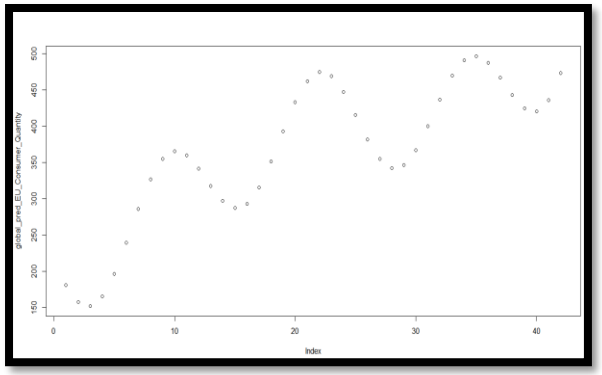


Fig.(c)

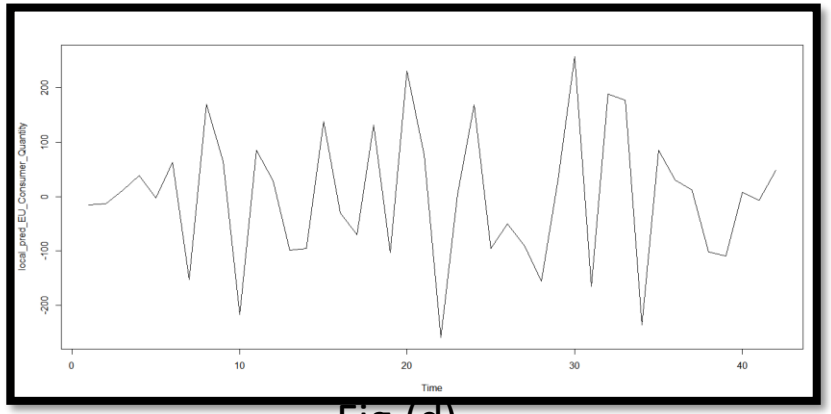
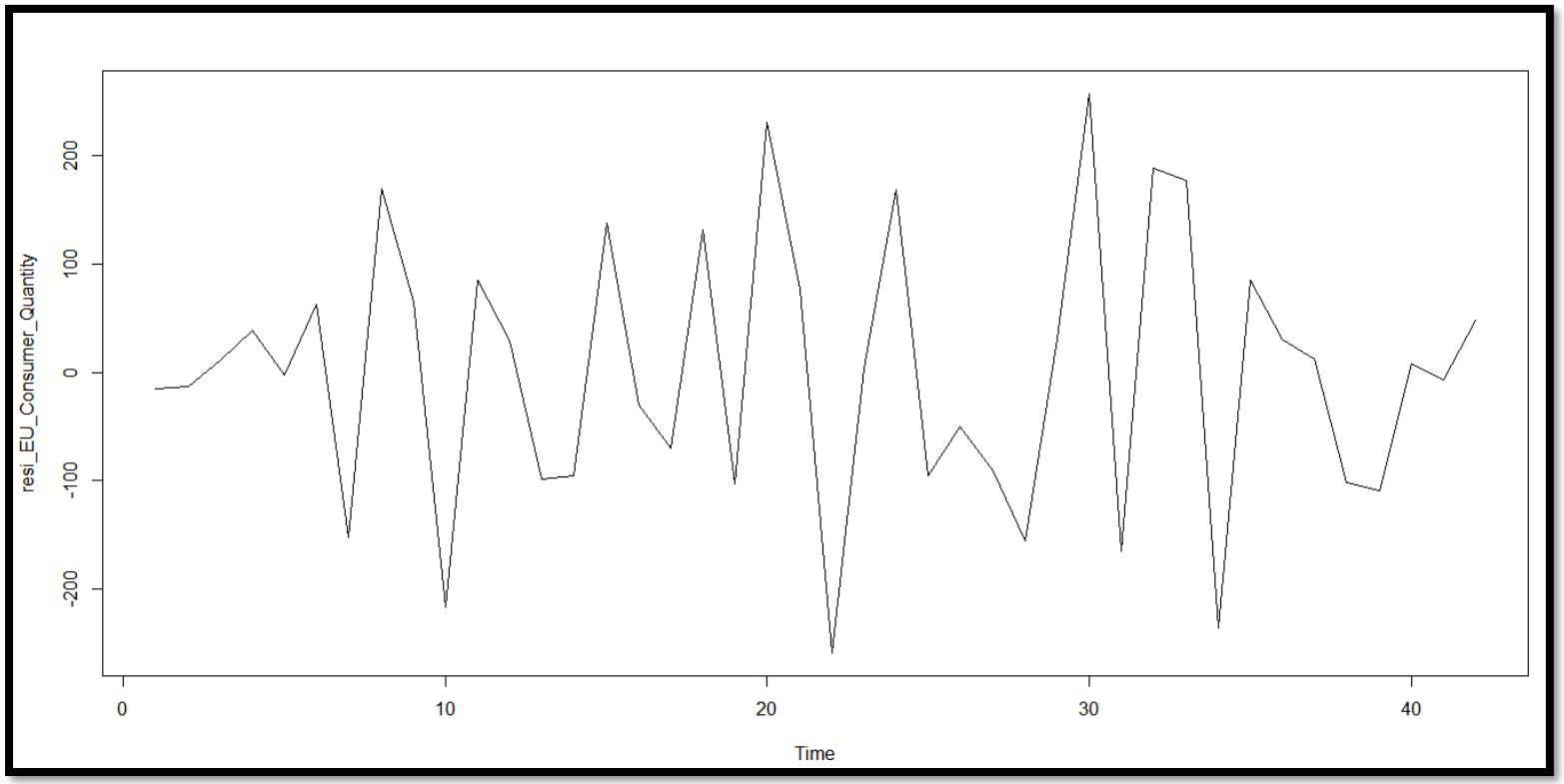


Fig.(d)

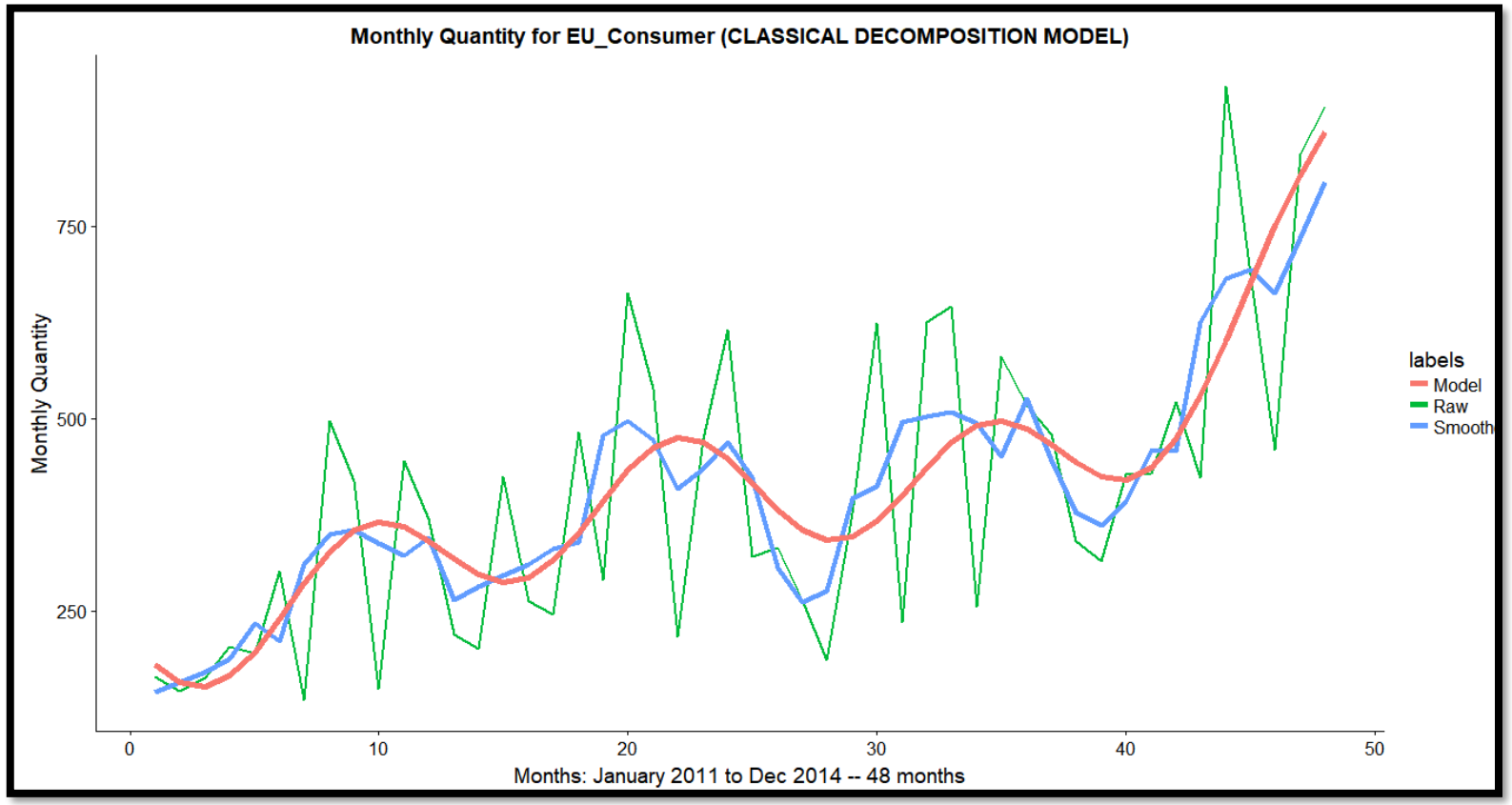
Time Series Analysis : EU_Consumer (Quantity)

Step 3: After applying auto.arima() on the local prediction, next step is to check if the remaining residual obtained is white noise. Following is the graph obtained for residual:



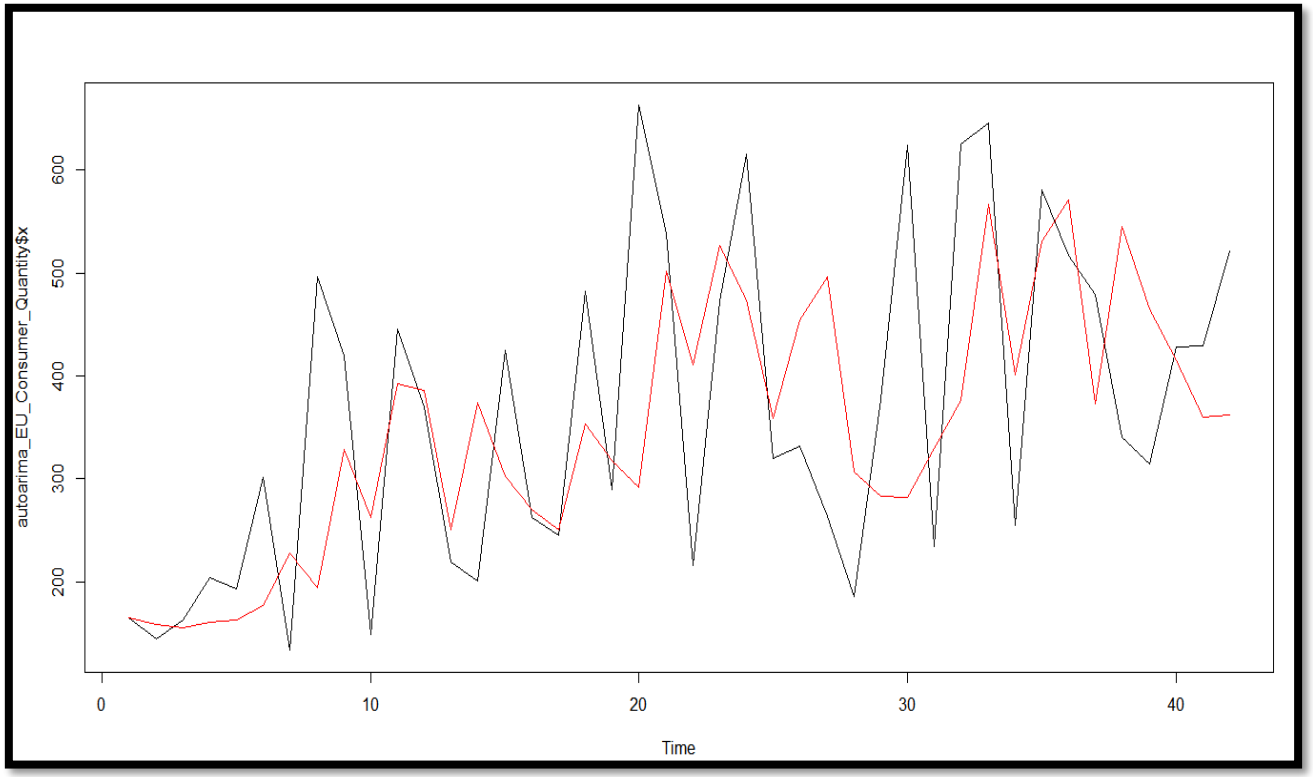
Step 4: adf test with pvalue = 0.02 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

Evaluating the Classical Decomposition model using MAPE :EU_Consumer (Quantity)



- After forecasting the sales value for last 6 months using the model created, we get MAPE = 22% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

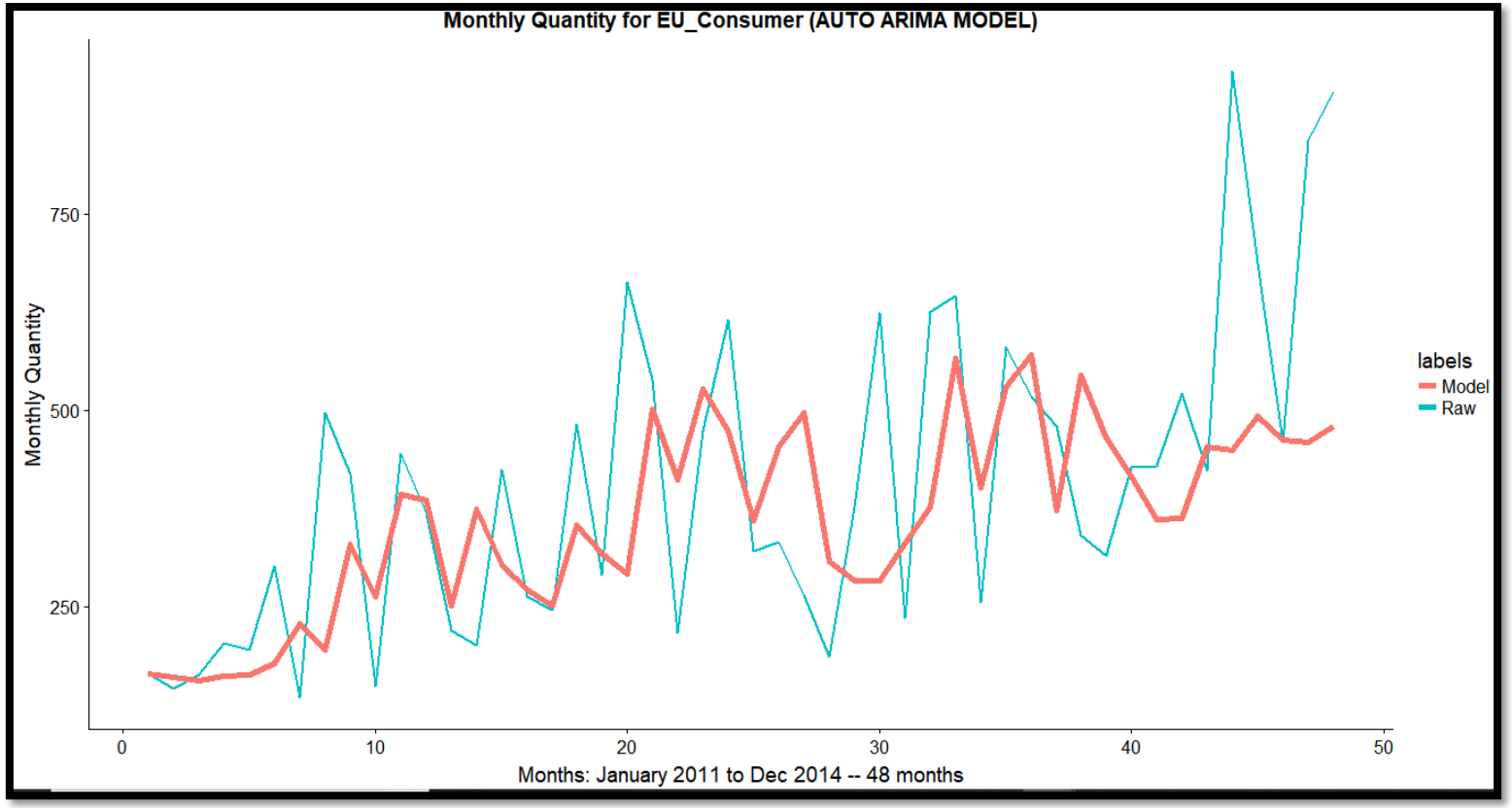
Model Building - Auto Arima :EU_Consumer (Quantity)



- Graph shows the model obtained using Auto Arima method.
- On checking if the residual is noise we get the following result:

  adf test with pvalue = 0.04 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

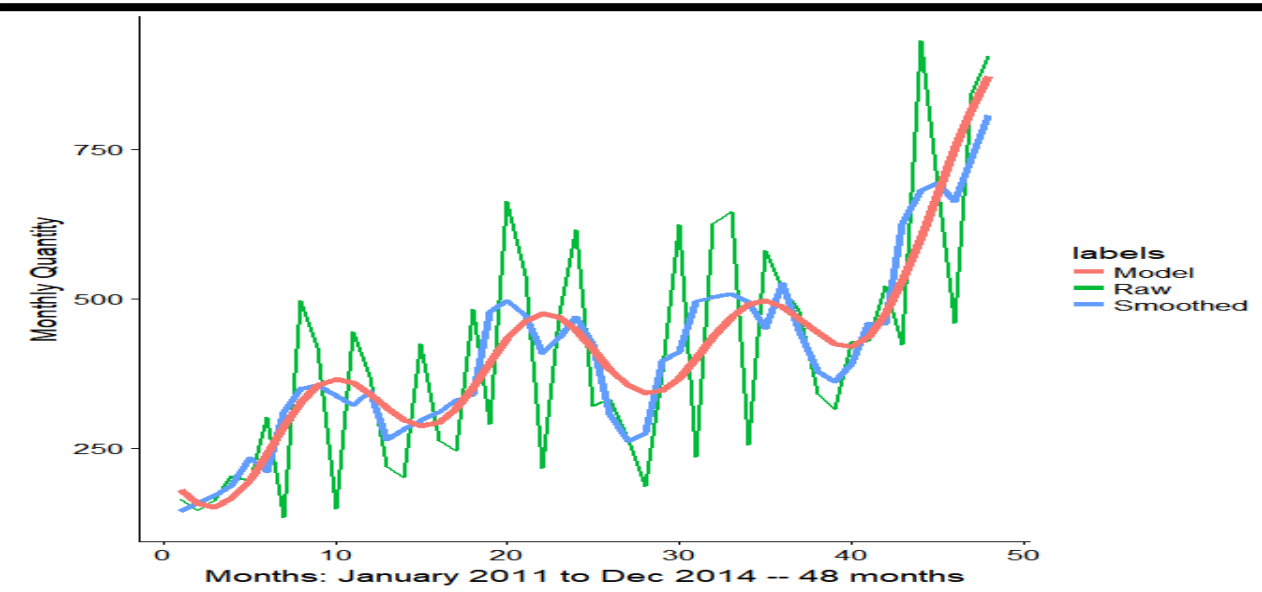
Evaluating the Auto Arima model using MAPE: EU_Consumer(Quantity)



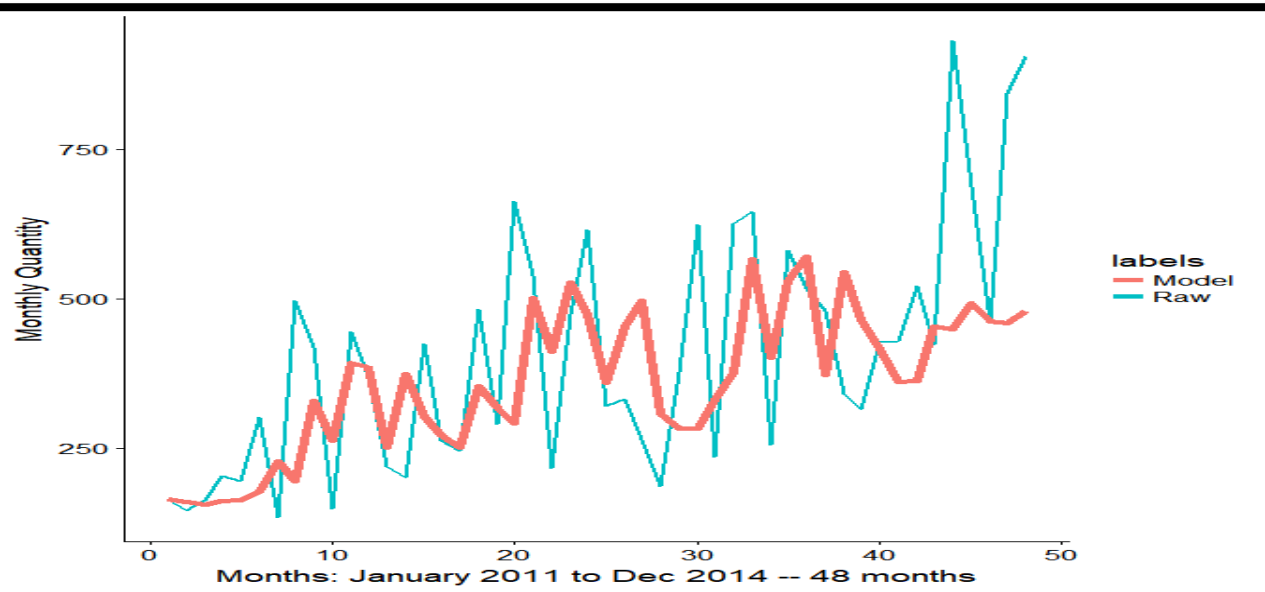
- After forecasting the sales value for last 6 months using the model created, we get MAPE = 30.13% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

COMPARING CLASSICAL DECOMPOSITION MODEL AND AUTO ARIMA MODEL: EU_Consumer (Quantity)

CLASSICAL DECOMPOSITION MODEL MAPE : 22%



AUTO ARIMA MODEL MAPE : 30%



Through Graphs as well as MAPE Values, we can conclude that the model prepared manually through classical decomposition will lead to better forecasts for this particular market_segment.

Time Series Analysis : Segment : APAC_Consumer

Time Series Analysis : APAC_Consumer (Sales)

Step : 1: Fig.(a) represents original time series ,smoothed series & model line after modelling trend and seasonality

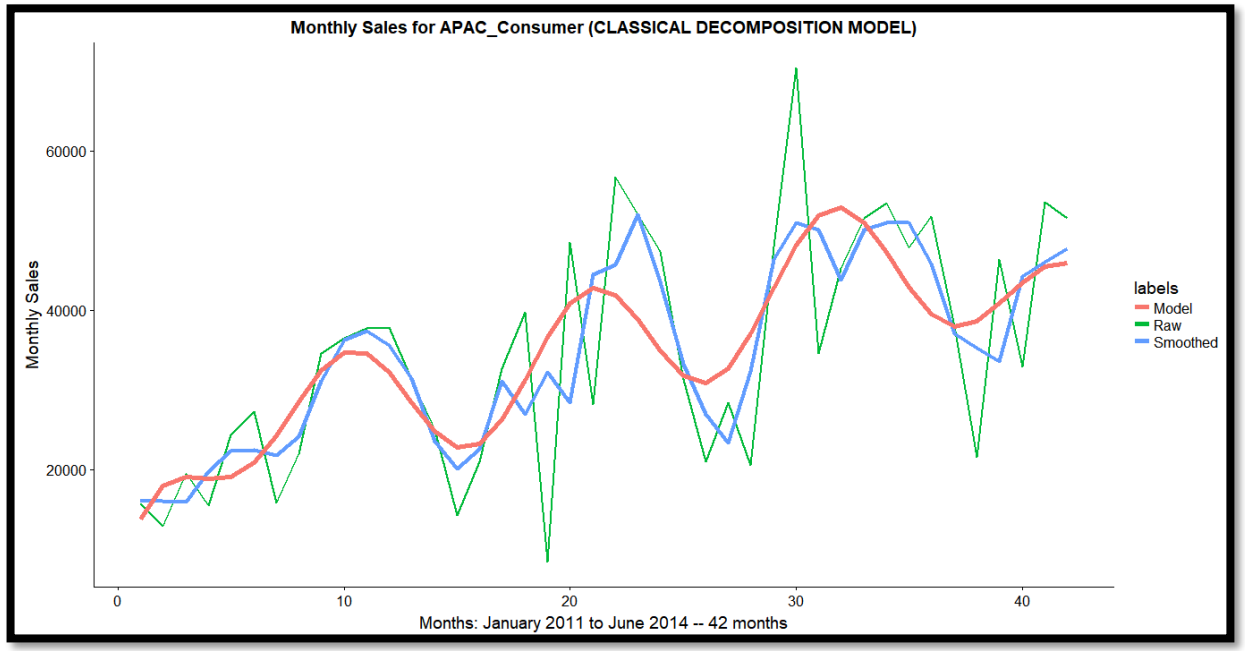


Fig.(a)

Step :2 : Locally predictable series(Fig:d) can be obtained by removing Trend and seasonality(Fig:c) from the original time series(Fig:b)

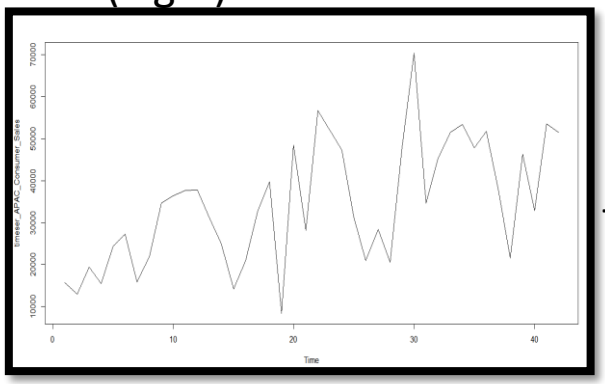


Fig.(b)

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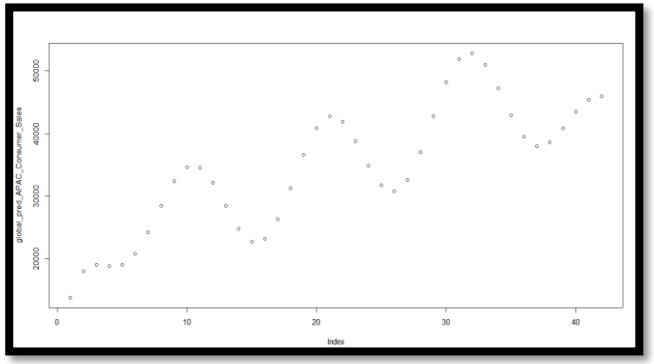


Fig.(c)

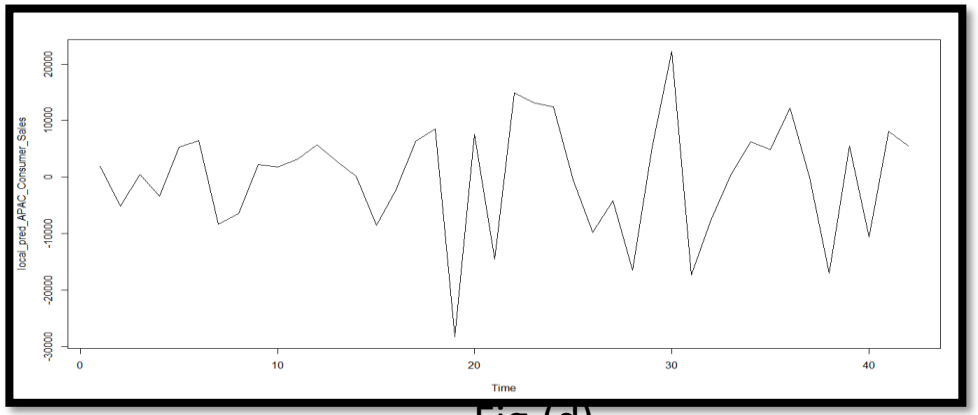
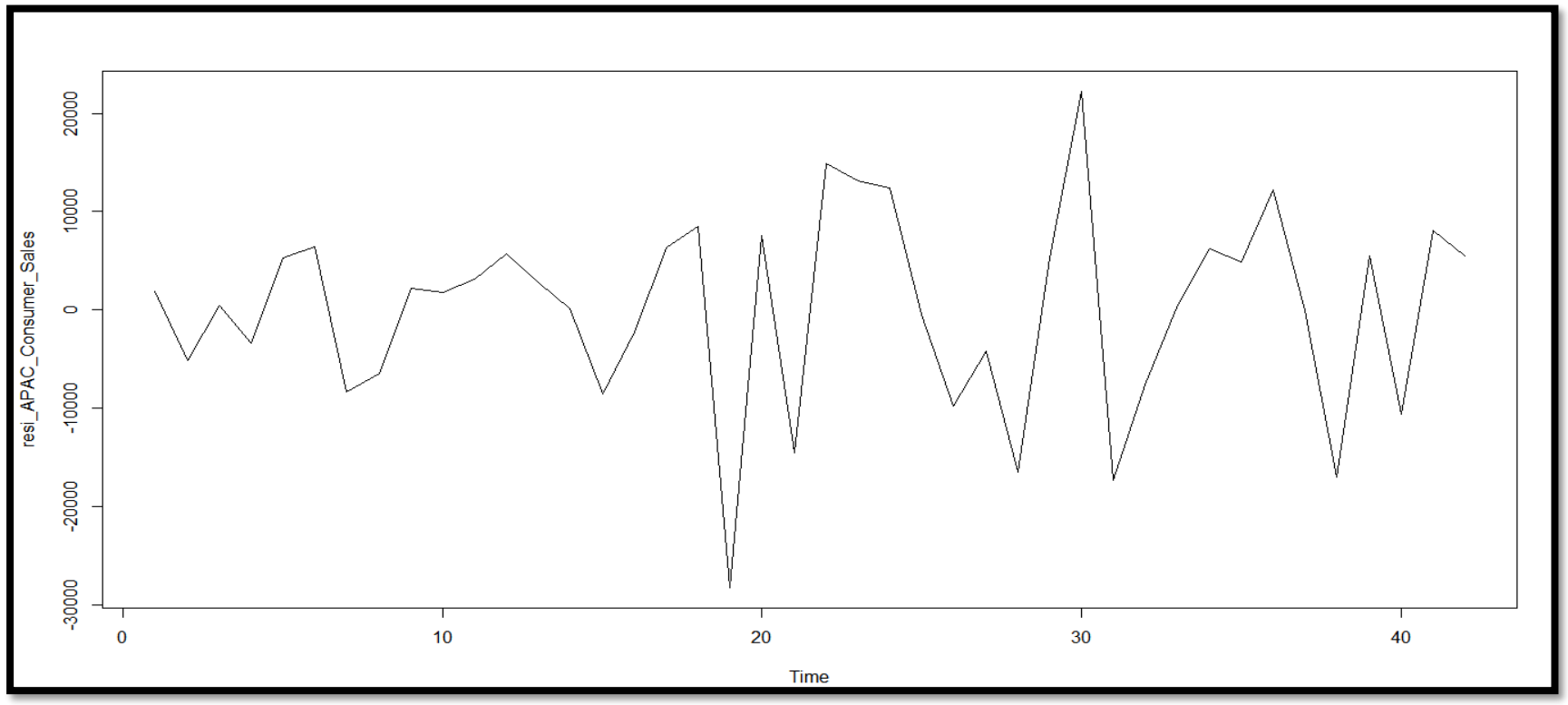


Fig.(d)

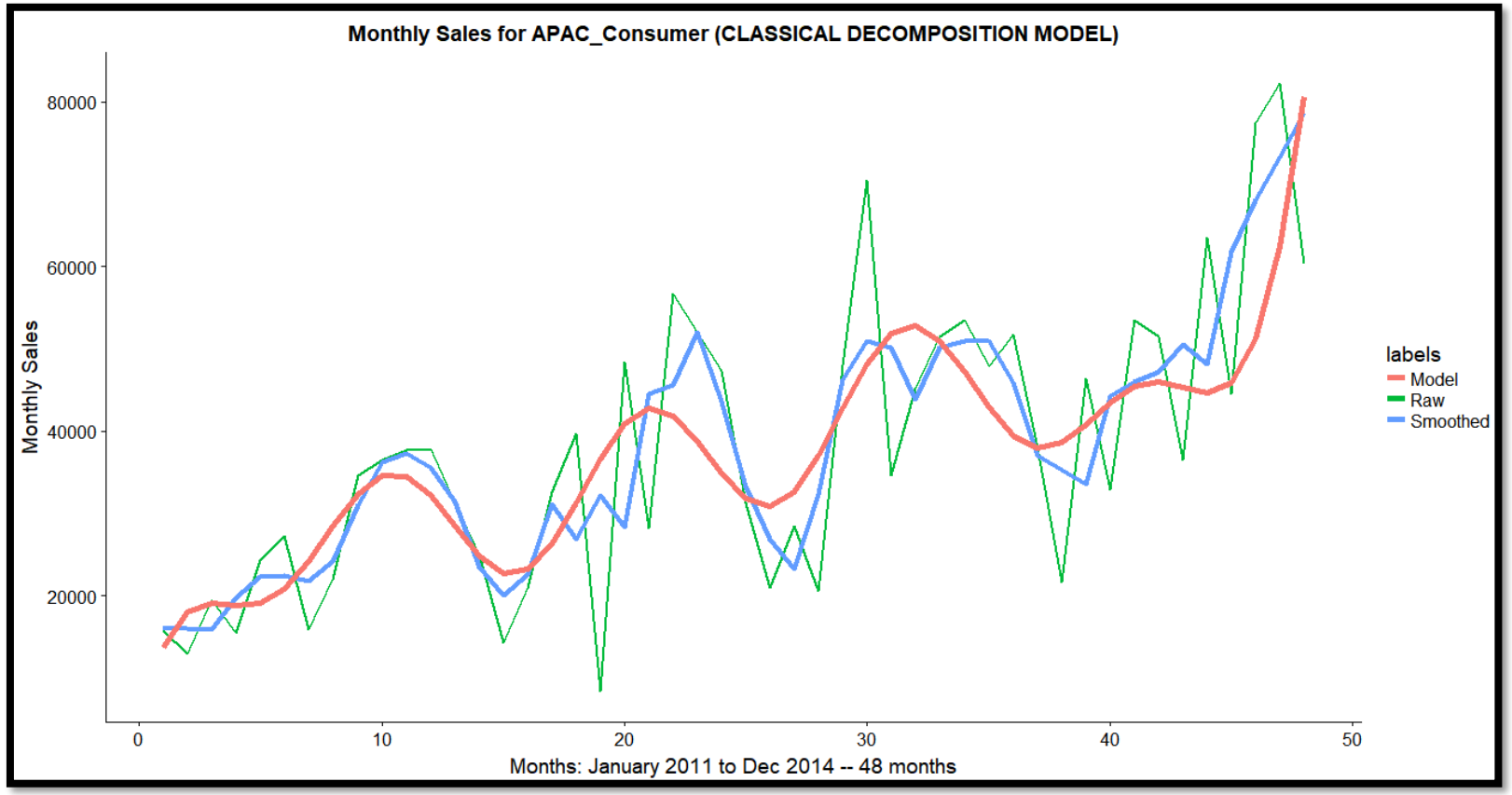
Time Series Analysis : APAC_Consumer (Sales)

Step 3: After applying auto.arima() on the local prediction, next step is to check if the remaining residual obtained is white noise. Following is the graph obtained for residual:



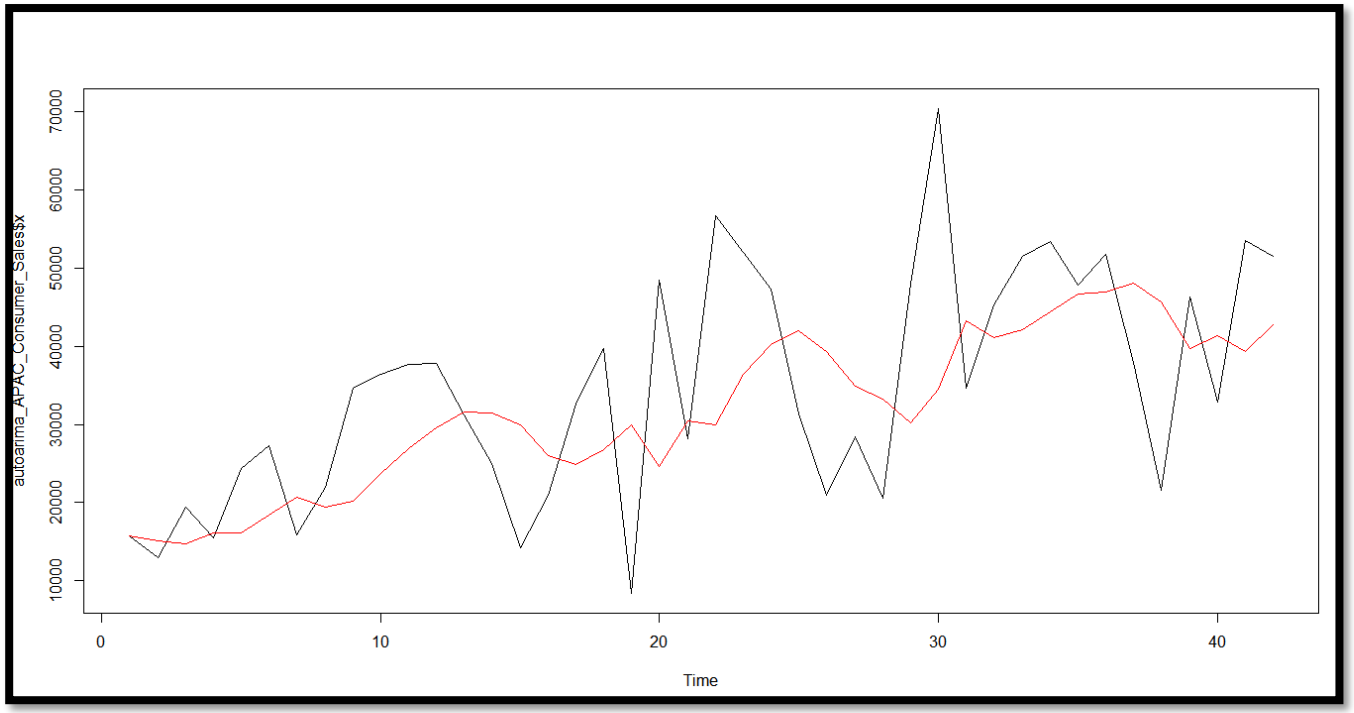
Step 4: adf test with pvalue = 0.01 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

Evaluating the Classical Decomposition model using MAPE : APAC_Consumer (Sales)



- After forecasting the sales value for last 6 months using the model created, we get MAPE = 24.7% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

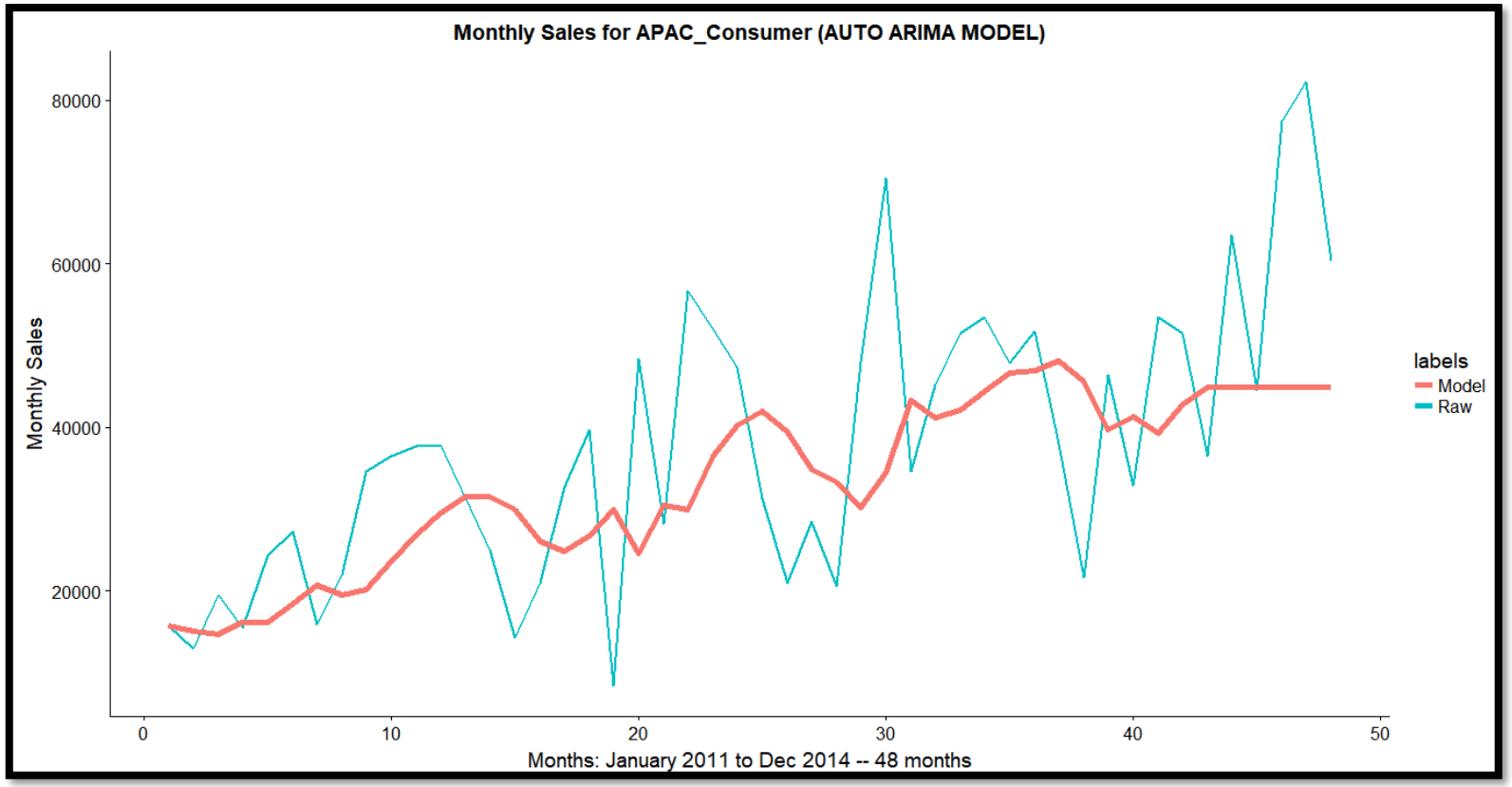
Model Building - Auto Arima : APAC_Consumer (Sales)



- Graph shows the model obtained using Auto Arima method.
- On checking if the residual is noise we get the following result:

  adf test with pvalue = 0.01 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

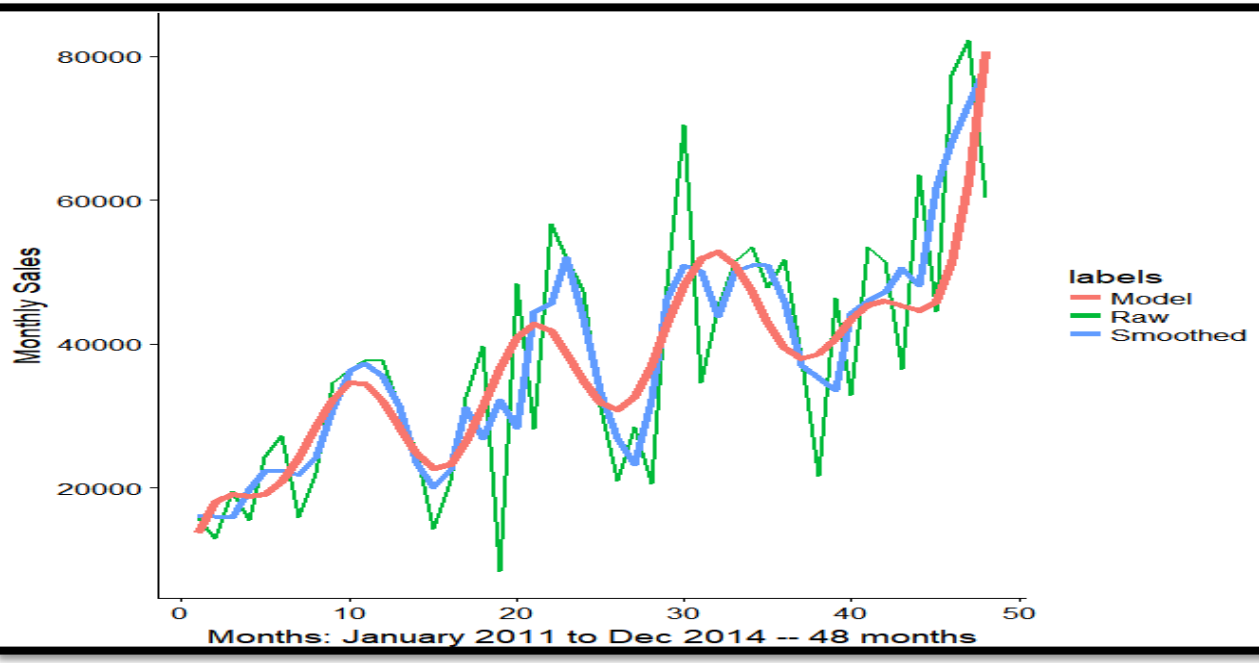
Evaluating the Auto Arima model using MAPE : APAC_Consumer (Sales)



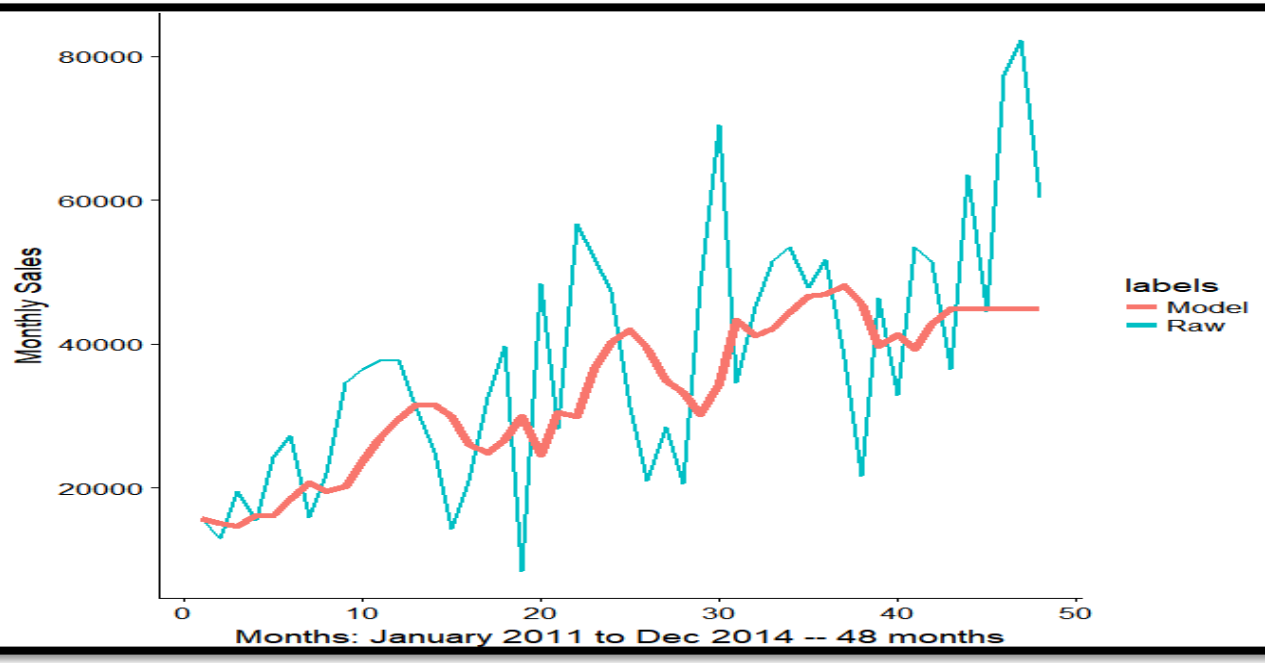
- After forecasting the sales value for last 6 months using the model created, we get MAPE = 27.68% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

COMPARING CLASSICAL DECOMPOSITION MODEL AND AUTO ARIMA MODEL : APAC_Consumer (Sales)

CLASSICAL DECOMPOSITION MODEL MAPE : 24.76%



AUTO ARIMA MODEL MAPE : 27.68%



Through Graphs as well as MAPE Values, we can conclude that the model prepared manually through classical decomposition will lead to better forecasts for this particular market_segment.

Time Series Analysis : APAC_Consumer (Quantity)

Step : 1: Fig.(a) represents original time series ,smoothed series & model line after modelling trend and seasonality

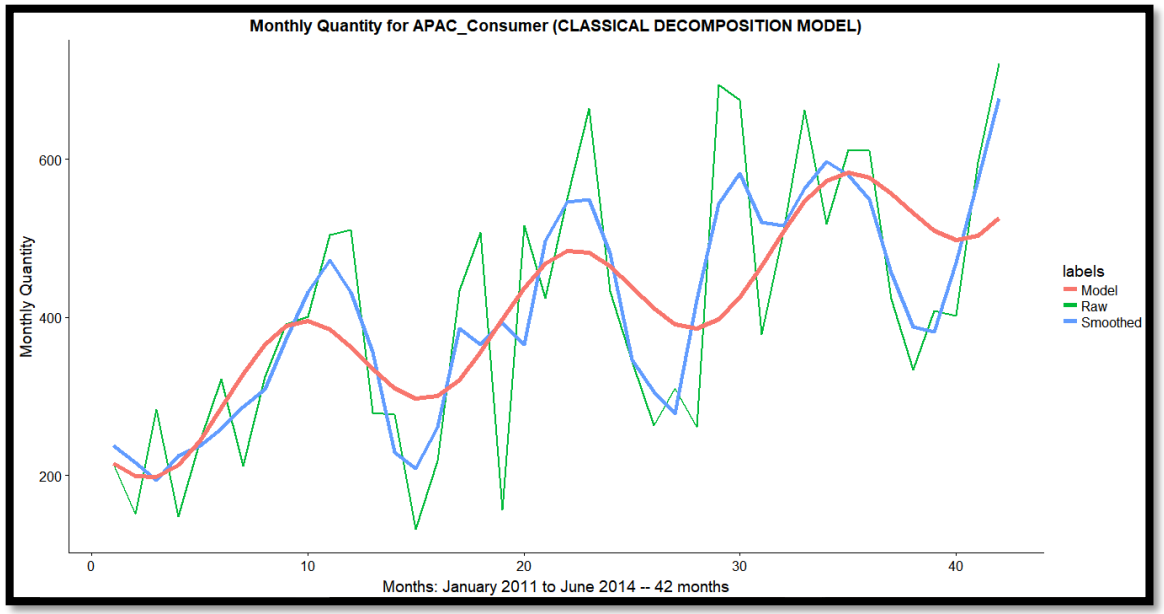


Fig.(a)

Step :2 : Locally predictable series(Fig:d) can be obtained by removing Trend and seasonality(Fig:c) from the original time series(Fig:b)

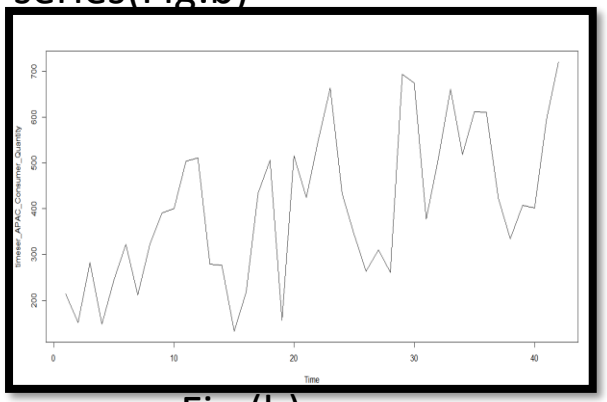


Fig.(b)

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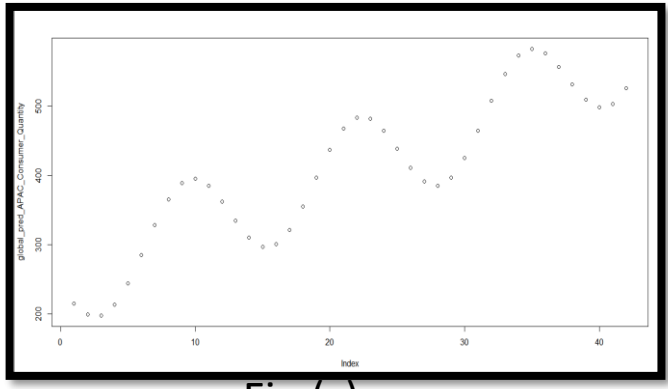


Fig.(c)

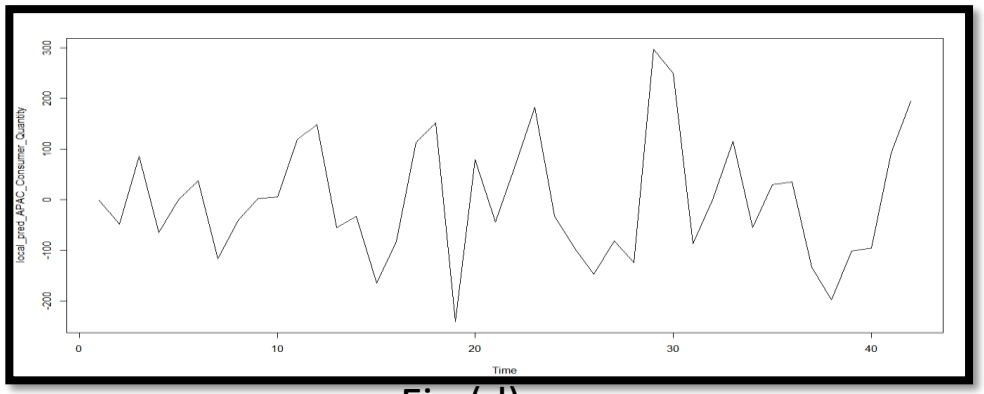
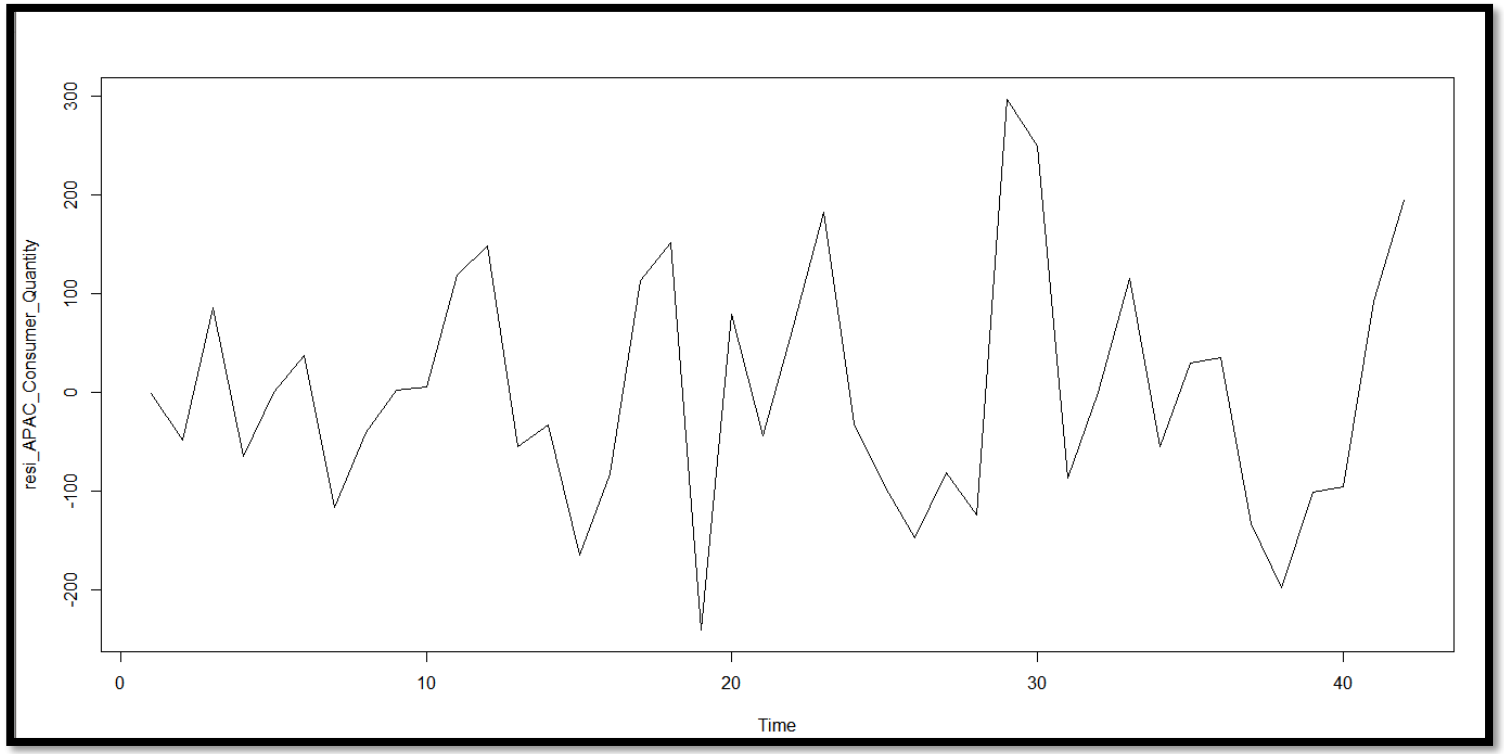


Fig.(d)

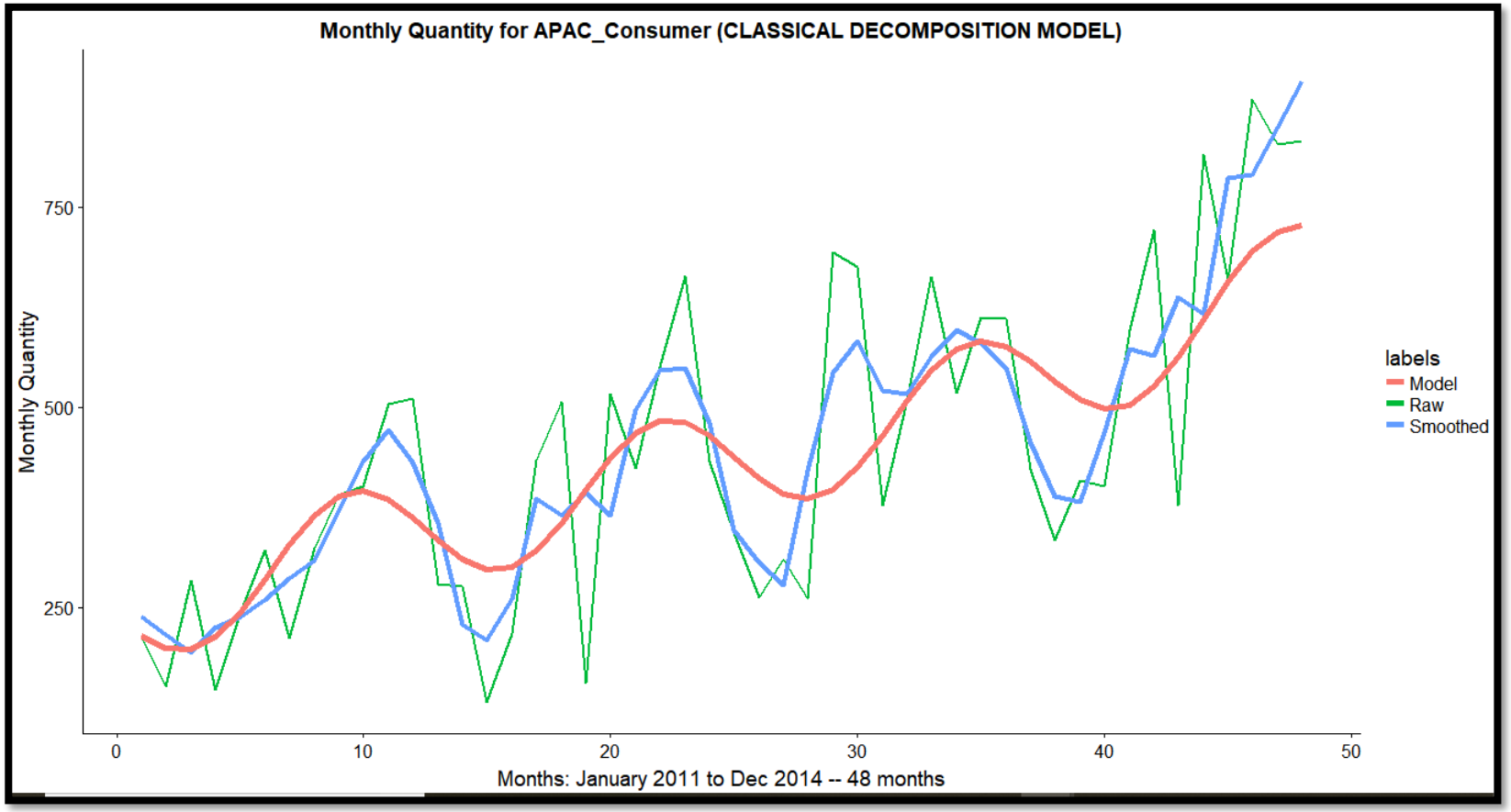
Time Series Analysis : APAC_Consumer (Quantity)

Step 3: After applying auto.arima() on the local prediction, next step is to check if the remaining residual obtained is white noise. Following is the graph obtained for residual:



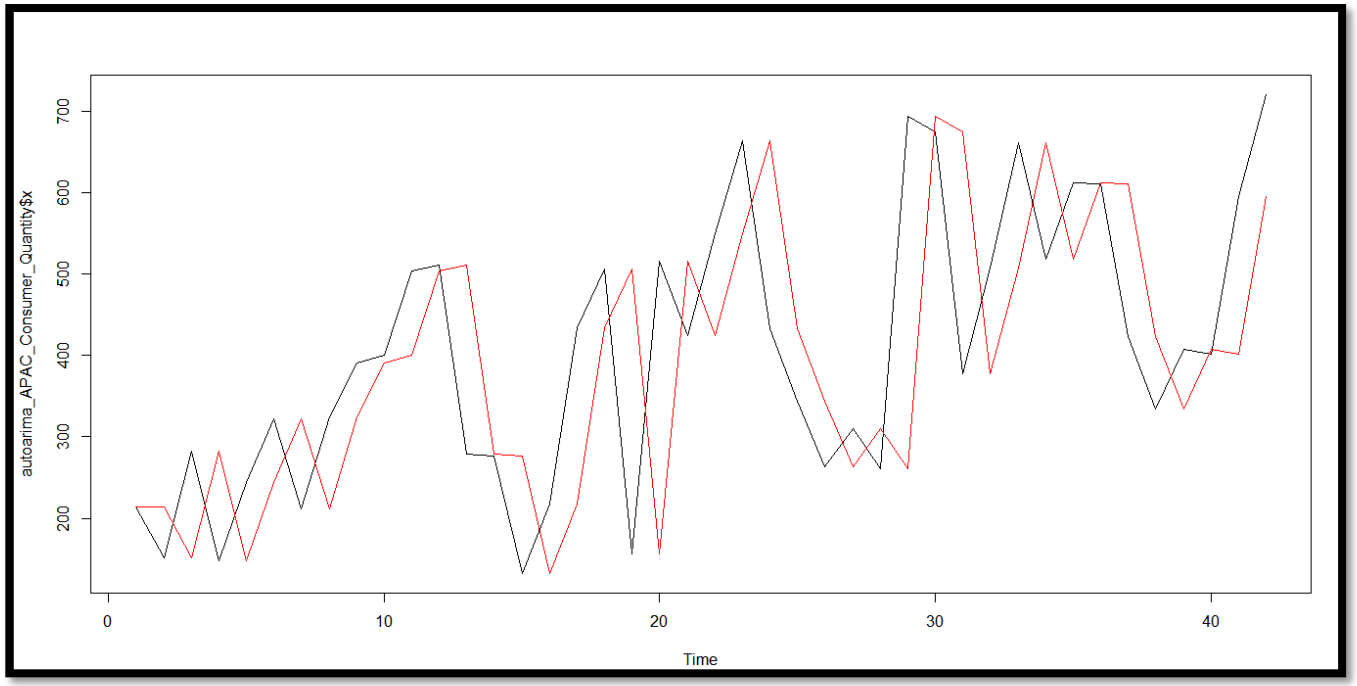
Step 4: adf test with pvalue = 0.01 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

Evaluating the Classical Decomposition model using MAPE : APAC_Consumer (Quantity)



- After forecasting the sales value for last 6 months using the model created, we get MAPE = 20% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

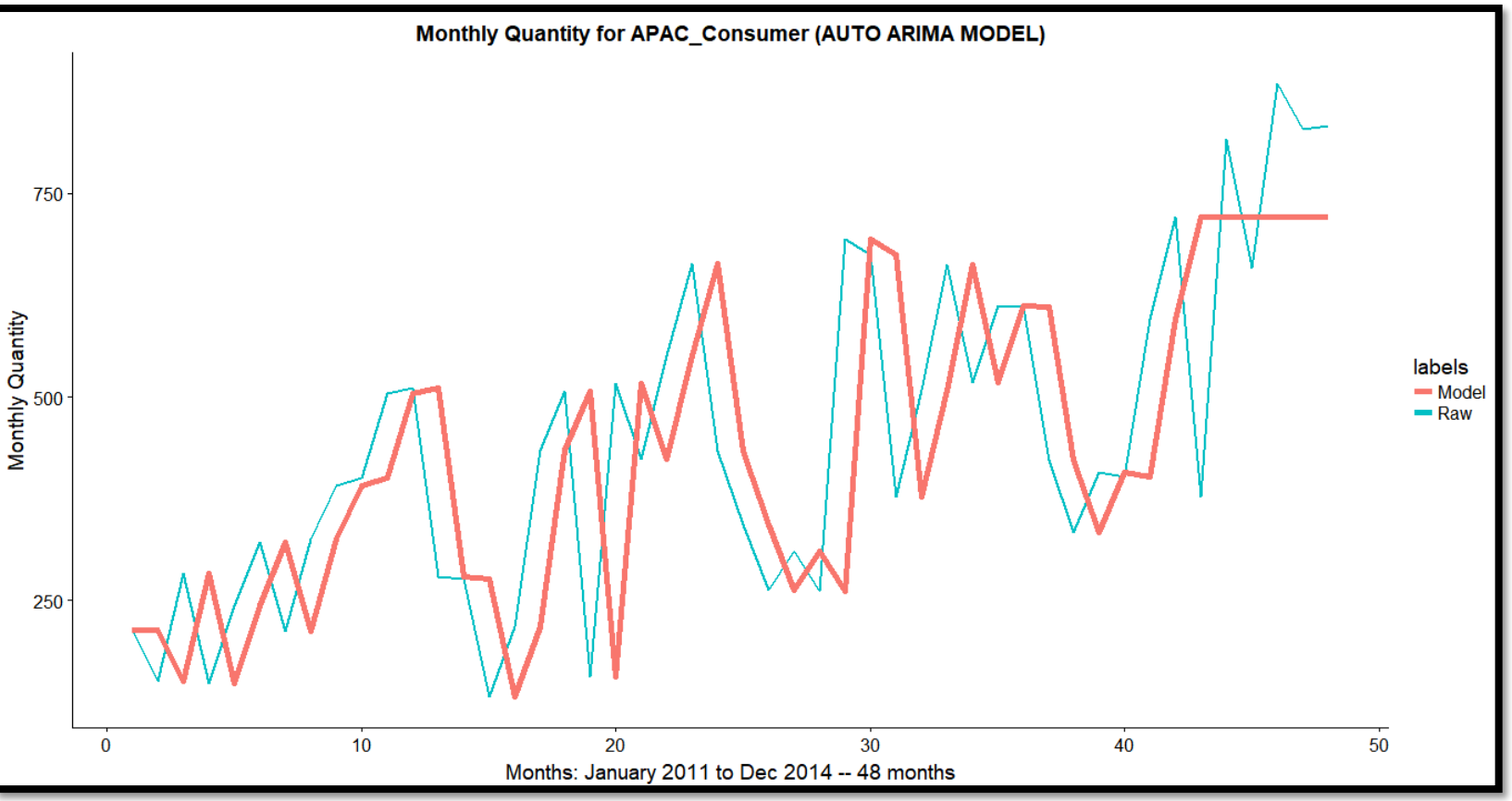
Model Building - Auto Arima : APAC_Consumer (Quantity)



- Graph shows the model obtained using Auto Arima method.
- On checking if the residual is noise we get the following result:

  adf test with pvalue = 0.01 and kpss test with pvalue 0.1 signifies that residual can be considered as white noise.

Evaluating the Auto Arima model using MAPE : APAC_Consumer (Quantity)

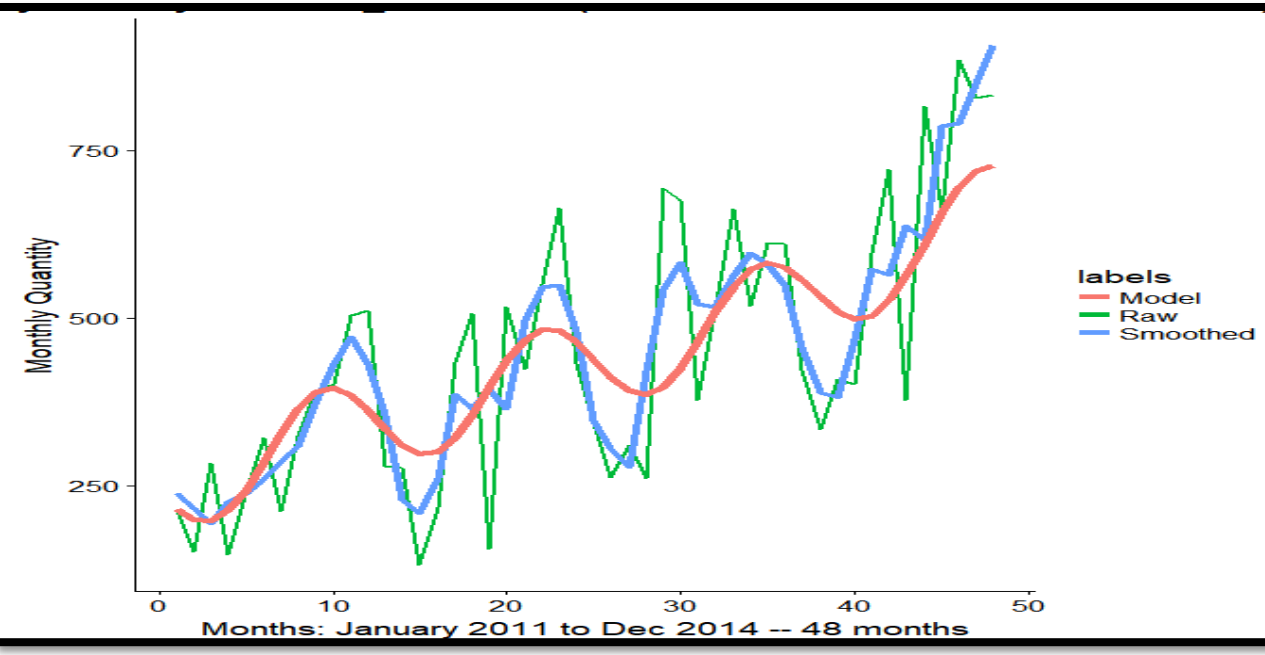


- After forecasting the sales value for last 6 months using the model created, we get MAPE = 26% on comparing forecasted values with actual values.
- Since the MAPE is lower, therefore model can be considered
- The graph shows original patterns with the predicted pattern.

COMPARING CLASSICAL DECOMPOSITION MODEL AND AUTO ARIMA MODEL : APAC_Consumer (Quantity)

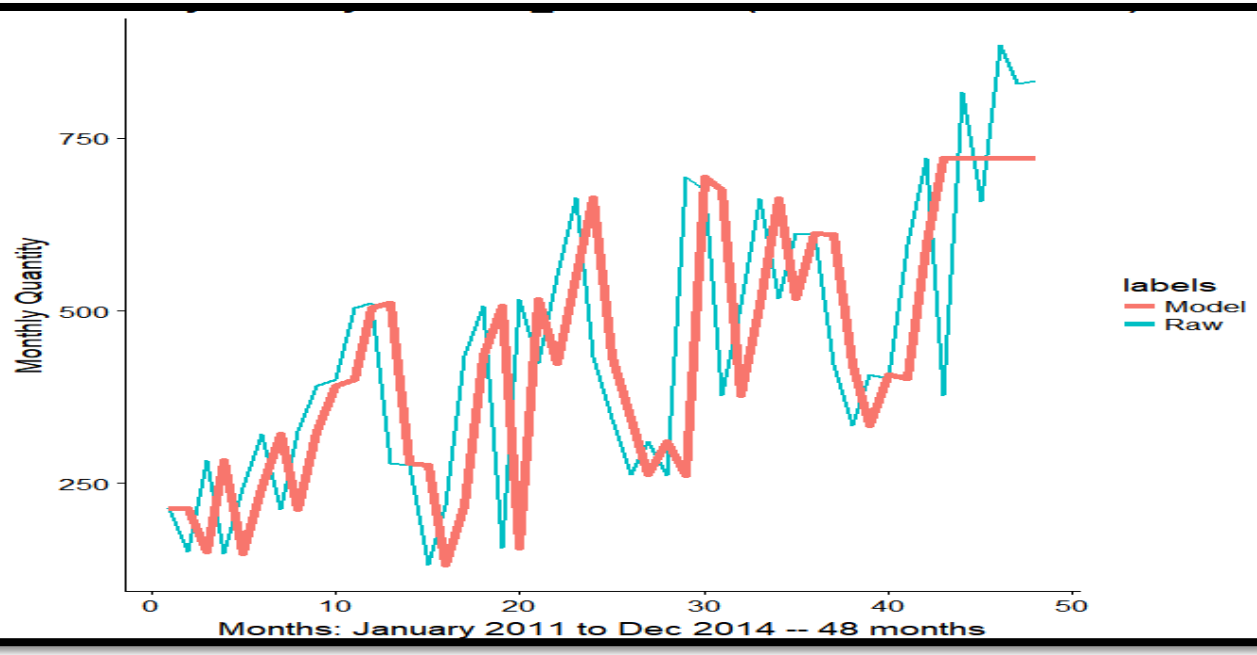
CLASSICAL DECOMPOSITION MODEL

MAPE : 20%



AUTO ARIMA MODEL

MAPE : 26%



Through Graphs as well as MAPE Values, we can conclude that the model prepared manually through classical decomposition will lead to better forecasts for this particular market_segment.

Also, the auto-arima model appears to be fitting better on the input data, but that is the case of overfitting, as it does not fit that well on output data.

Thank You…