Global Mart Case Study

Sales & Demand Forecasting

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Strategy and Business Objectives

Problem Statement

- To identify the 2 most profitable (and consistent) segment and forecast the sales & demand in these segments for the next 6 months using classical decomposition and auto ARIMA Modelling technique.

Business Objective

- To understanding the sales and the demand forecasting in order to finalize the plan for next 6 months that would help to manage the revenue and inventory for the organization.

Business Impact

- Resource and inventory management
- Revenue management

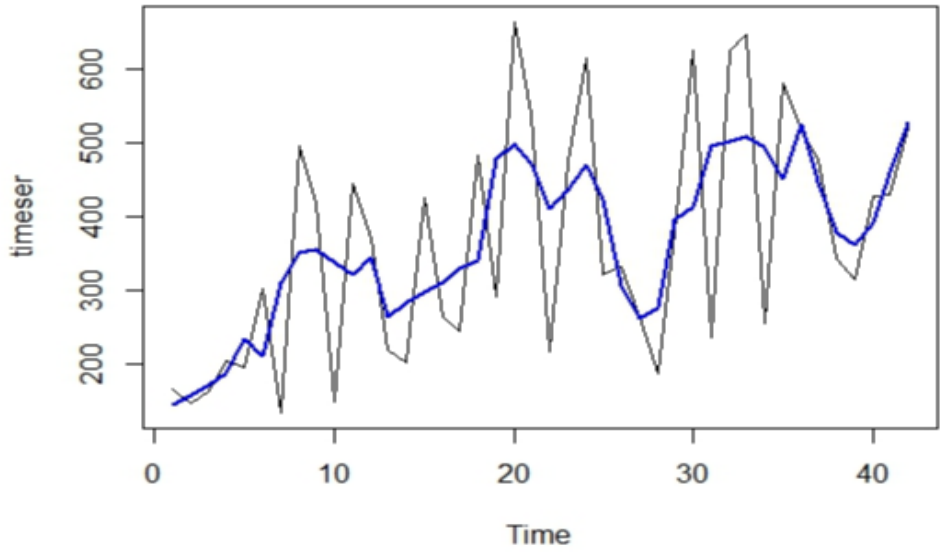
Data - 51290 unique transactional with 24 attributes (Year 2011- 2014)

- The data currently has the transaction level data for 48 months, where each row represents a particular order made on the online store
- There are 24 attributes related to each such transaction. The “Market” attribute has 7-factor levels representing the geographical market sector that the customer belongs to.
- The “Segment” attribute tells which of the 3 segments that customer belongs to.
- But not all of these 21 market buckets (Market + segment) are important from the store’s point of view and identify 2 most profitable buckets and forecast demand & sales for next 6 months.

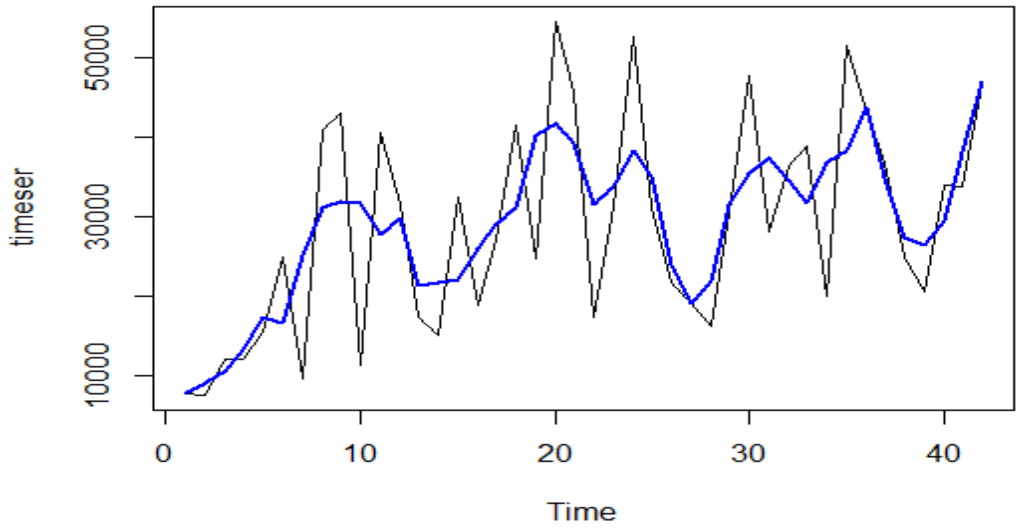
Data Preparation and Exploratory Data Analysis

- Missing Values (NA's) are available only in 'postal code' attribute for markets other than US
- Based on CV(Coefficient of variance) metrics , **EU + Consumer** and **APAC + Consumer** are the most profitable and consistent segments so we will forecast the sales and demand for it

EU + Consumer Demand Smoothed TS

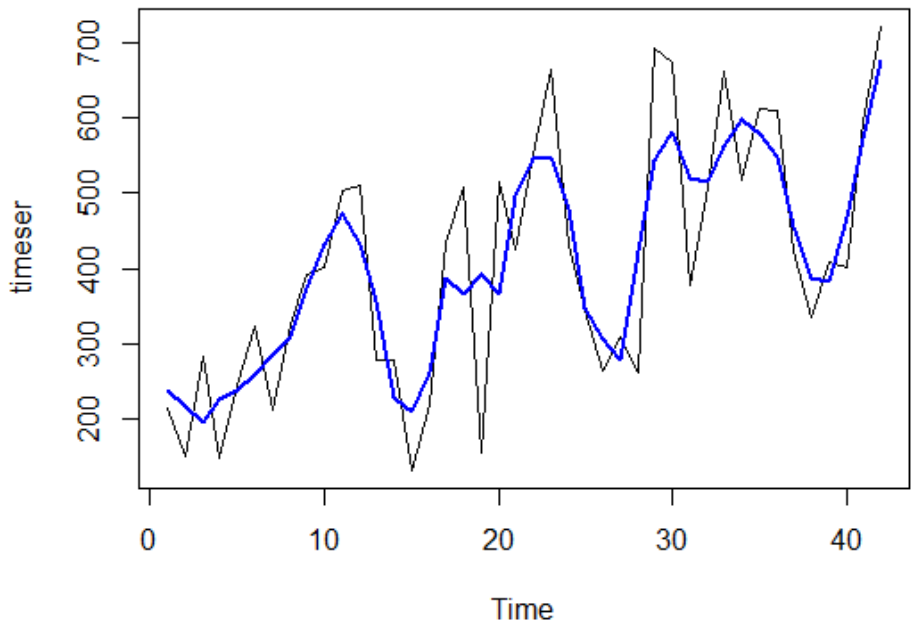


EU+ Consumer sales Smoothed TS

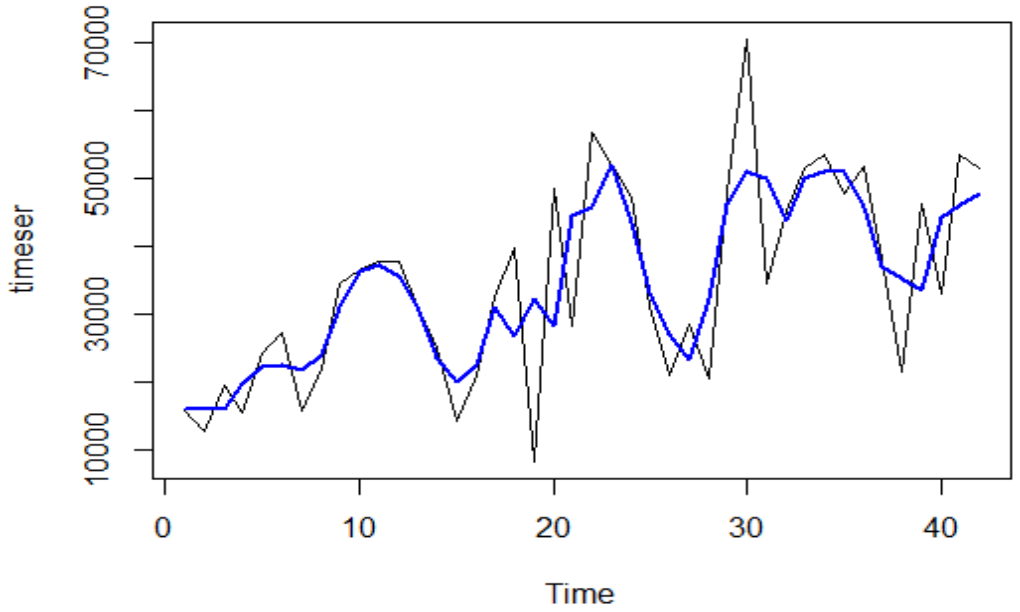


Data Preparation and Exploratory Data Analysis …continue

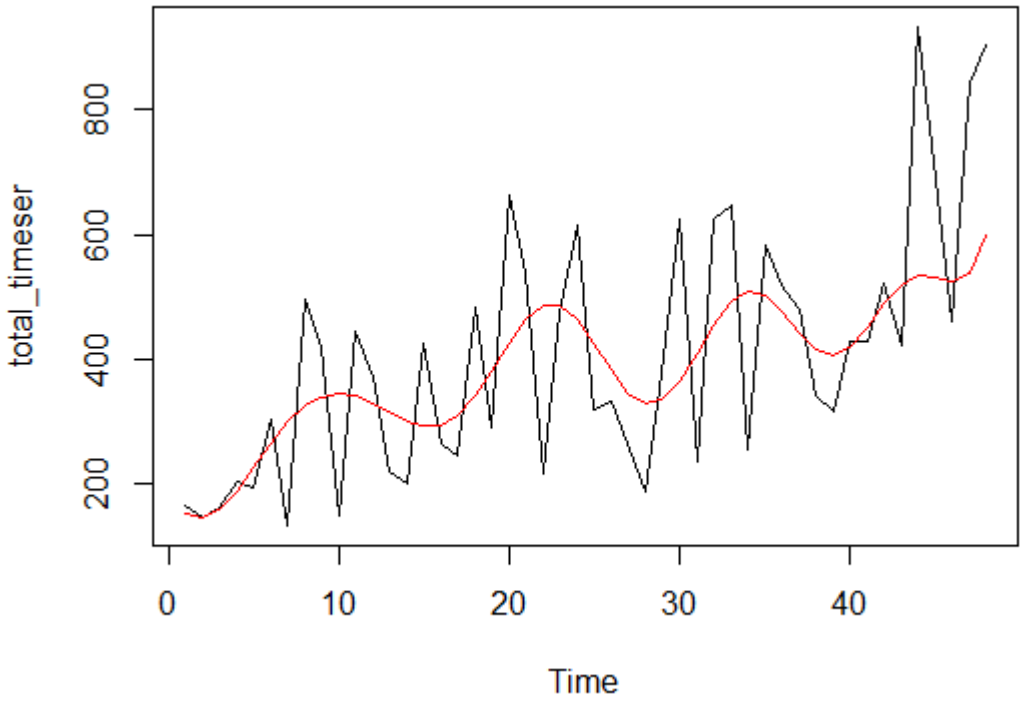
APAC + Consumer smoothed demand TS



APAC + Consumer smoothed Sales TS



EU + Consumer Demand (Quantity) Time Series Modelling

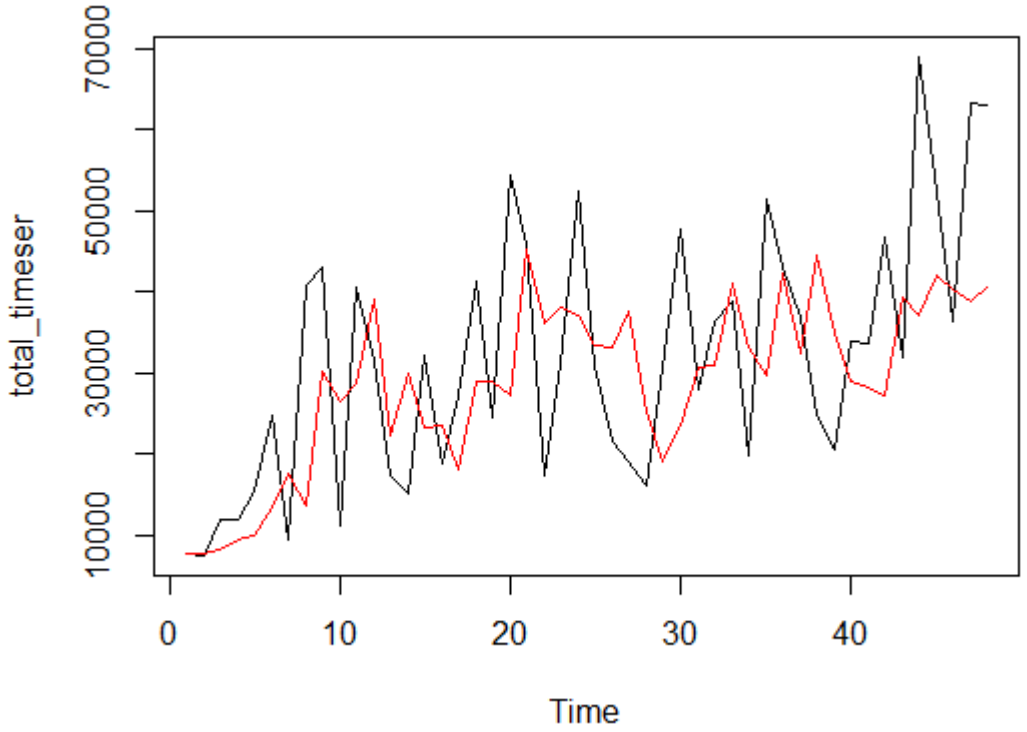


- Seasonality modelled using sinusoid function *"sin(0.5*Month) * poly(Month,3) + cos(0.1*Month) * poly(Month,1)"*
- **Classical Decomposition** model has got better **MAPE (28.76)** than ARIMA model MAPE (30.13) Hence we considered Classical Decomposition technique to forecast sales & demand.
- Model characteristics are as below

```
Series: local_pred
ARIMA(0,0,0) with zero mean

sigma^2 estimated as 14918:  log likelihood=-261.41
AIC=524.82   AICc=524.92   BIC=526.56
```

EU + Consumer Sales Time Series Modelling



- **ARIMA Model** has got better **MAPE (28.92)** than classical decomposition model MAPE (92.95) Hence we considered ARIMA model to forecast sales & demand.

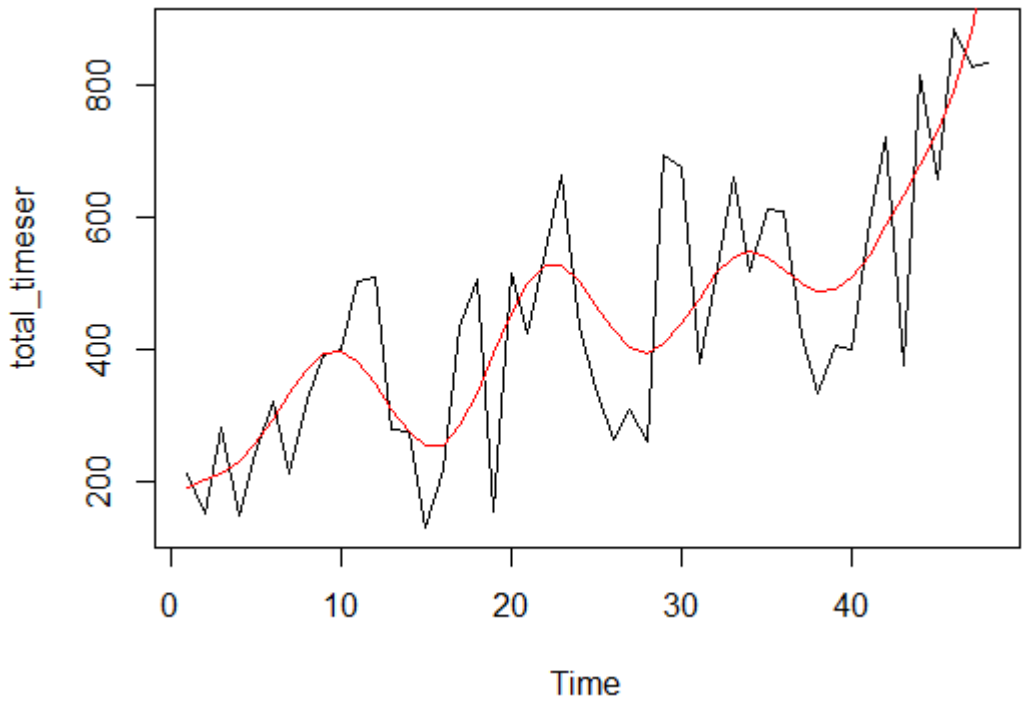
- Model Characteristic are as below

```
Series: timeser
ARIMA(2,1,0)

Coefficients:
          ar1      ar2
      -0.5796  -0.4906
s.e.   0.1346   0.1310

sigma^2 estimated as 168564623:  log likelihood=-445.84
AIC=897.67   AICc=898.32   BIC=902.81
```

APAC + Consumer Demand (Quantity) Time Series Modelling

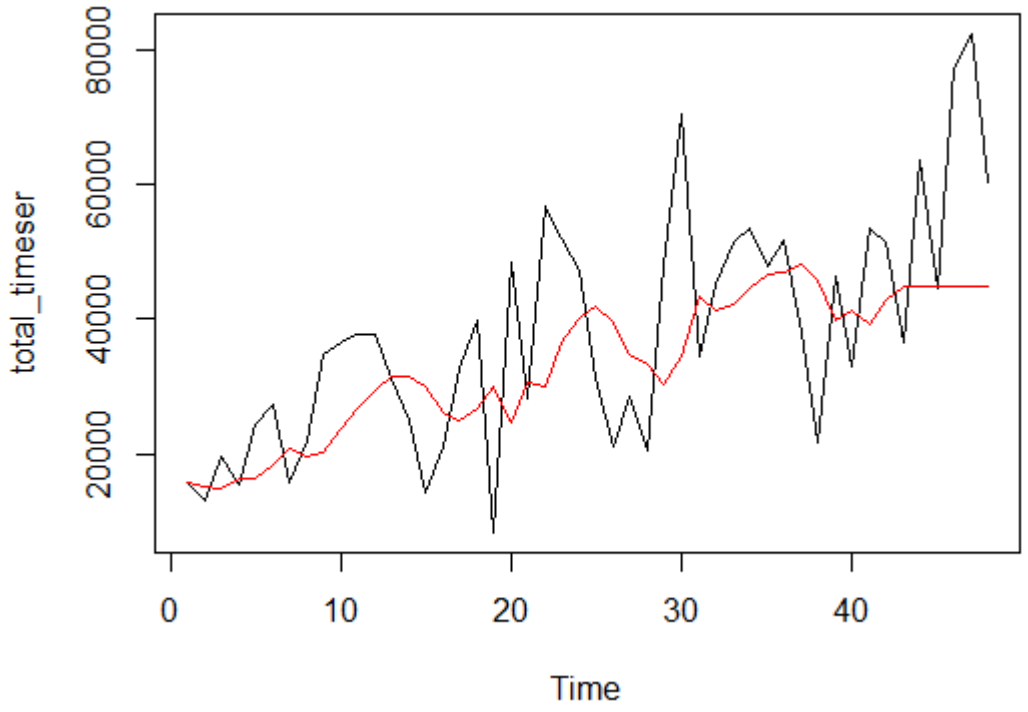


- Seasonality modelled using sinusoid function *"sin(0.5*Month) * poly(Month,3) + cos(0.1*Month) * poly(Month,1)"*
- **Classical Decomposition** model has got better **MAPE (22.45)** than ARIMA model MAPE (26.24) Hence we considered Classical Decomposition technique to forecast sales & demand.
- Model characteristics are as below

```
Series: local_pred
ARIMA(0,0,0) with zero mean

sigma^2 estimated as 13121:  log likelihood=-258.72
AIC=519.43   AICc=519.53   BIC=521.17
```

APAC + Consumer Sales Time Series Modelling



- **ARIMA Model** has got better **MAPE (27.68)** than classical decomposition model MAPE (31.07) Hence we considered ARIMA model to forecast sales & demand.

- Model Characteristic are as below

```
Series: timeser
ARIMA(0,1,1)

Coefficients:
          ma1
      -0.7559
s.e.   0.1381

sigma^2 estimated as 174361555:  log likelihood=-447.11
AIC=898.23   AICc=898.55   BIC=901.66
```

Forecasted Values for 2 most profitable segments

EU + Consumer

Time	Forecast Demand
49	732.4286
50	946.1558
51	1228.5347
52	1545.1223
53	1846.0360
54	2079.5269

Time	Forecast Sales
49	39297.86
50	37221.06
51	42062.87
52	40275.32
53	38936.08
54	40589.28

APAC + Consumer

Time	Forecast Demand
49	1207.651
50	1459.742
51	1767.493
52	2115.361
53	2481.993
54	2846.909

Time	Forecast Sales
49	44898.7
50	44898.7
51	44898.7
52	44898.7
53	44898.7
54	44898.7