



FORECASTING THE GROWTH OF OVERSEAS TRAVELLERS IN UK FOR 2019

Group B9

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INTRODUCTION

Demand forecast in tourism is of great economic value both for the public and private sector. Any information concerning the future evolution of tourism flows is of great importance to hoteliers, tour operators and other industries concerned with tourism.

Our Client is a Tours and Travel agency who wants to efficiently plan its offerings according to different segments for the upcoming year and ensure adequate capacity and infrastructure.

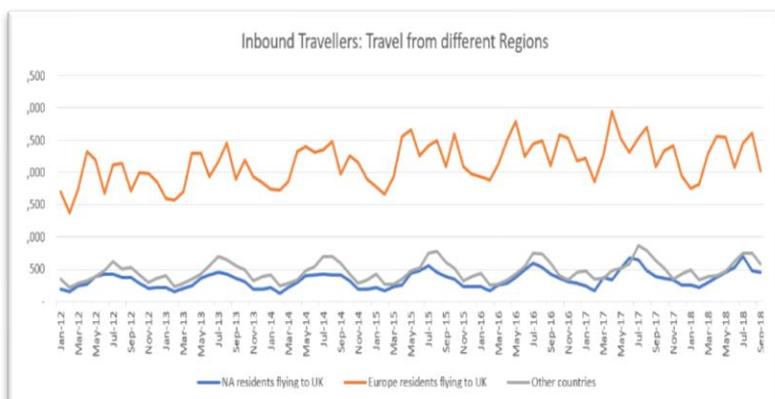
EXECUTIVE SUMMARY

Problem Definition: Tour and Travel agents in UK (eg. Thomas Cook) need to plan demand while making their advance bookings of bus, flights, hotels etc. that they can offer to their varied customers (business, Leisure, family etc.) as packages. Knowing the right demand can really help the travel agents maximize their revenues by not losing out on potential customers and minimize wasteful costs by not making unnecessary bookings in advance. Through this report we are designing a model to forecast the number of tourists traveling to UK with different purposes and from various parts of the world (i.e. Europe, North America or Other regions). This model can also be leveraged to price their packages, keeping in mind advance bookings made and demand forecasts to squeeze out the maximum margins from the limited resources they may have.

Data Description: The data obtained includes number of monthly inbound travellers to UK from regions travelling for different purposes from Jan'12-Sep'18 [Total: 81 months].

Source: Data is collected by UK government every quarter (source: www.ons.gov.uk) and is updated every quarter, leading to a lag of 3 months in data reporting.

Key Characteristics:

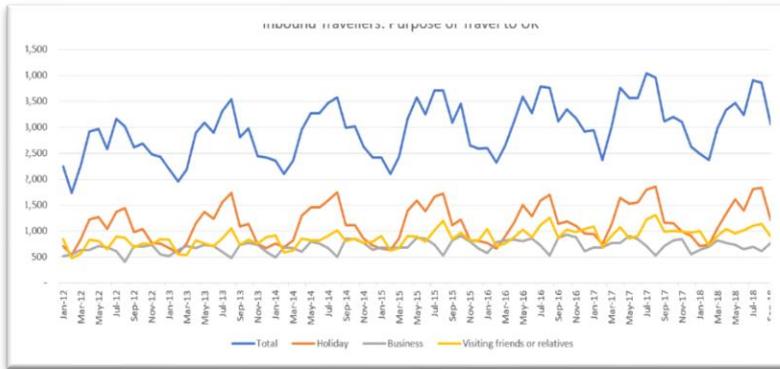


Yearly Seasonality and trend can be observed in all the time series and 3 different peak seasons can be identified based on purpose of travel

Business travellers: Apr-Jun and Sep-Nov

Leisure travellers: May to Sep

Visiting friends / family: Jun-Sep



Surprisingly, growth in overall inbound travel in UK is observed in 2017; it is probably due to currency depreciation post Brexit that made inbound travel to UK cheaper.

There is a sudden dip in 2018 as well, probably because of following 2 reasons

- People who would have originally travelled in 2018 already travelled in 2017
- Brexit to complete in Mar 2019, hence people preferring less to travel to UK for work purposes

Forecasting description: To provide a year's forecast of the demand, we ran several analytical models on different series namely: Seasonal Naïve, Holt Winter's (Additive & Multiplicative), Linear regression using dummy variables and exchange rate (to capture Brexit) and Ensemble models. For overall inbound UK travel, the best performing method is Multiplicative Holt Winters with a MAPE of 5.7% in validation, as compared to seasonal Naïve MAPE of 5.8, hence performing slightly better than seasonal naïve model. Holts' Winter with high levels of Alpha and Beta was really able to capture the effect of Brexit well in the forecast. Linear Regression models for visitors travelling with different purpose were finally selected after comparing with seasonal Naïve benchmark and error plots. Through research we also found that COGS comprise 80% of revenues of travel agents, thus cost of over forecasting is much greater than cost of under forecasting.

RECOMMENDATIONS TO THE CLIENT

- **Frequency of forecast update:** We recommend our client to update the model every 6 months to incorporate more accurate data available closer to travel date owing to changes in travel plans.
- **Curated offerings for different types of customers:** Based on the different series analyzed, we see 3 key segments with bit distinct seasonalities. We recommend our client to curate customized packages for each segment taking into consideration the time of travel, purpose and place of origin.
- **Connecting with external information:** The UK traveler is often a repeat visitor; we recommend our client to collect data at an individual level so that it can be used to improve customer experience by offering personalized packages for his/her future visits

POTENTIAL LIMITATIONS: Following factors lead to potential inaccuracies in forecasts

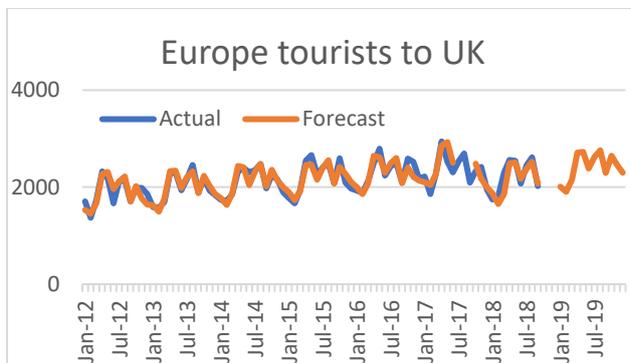
- Changing consumer behaviour: An increasing proportion of consumers book holidays independently or online using companies such as Expedia, Opodo and lastminute.com. This move towards online and independent booking reduces potential clients for our client.
- Lag in availability of data
- Forecasting with sudden dips in demand for visitors from Europe due to Brexit etc.
- Upcoming world cup and speculated change in demand; No past data useful to model
- Travel behaviour also affected due to currency appreciation / depreciation

TECHNICAL SUMMARY AND DATA ANALYSIS

The six time-series data were partitioned into Training and Validation such that Training period was 66months (Jan-12 to Jun-17). A 3month lag was maintained because of delays in data reporting. Validation period of 12 months was taken to cater for seasonality and number of forecasts required. Described below are the six time series which have been analysed using multiple forecasting models.

A. TRAVEL FROM REGION: EUROPE - FROM JAN 2012 – SEP 2018

Data preparation: Certain external data for exchange rates was considered and included in the regression to capture the effect of Brexit on the model. A dummy variable for pre-post Brexit was also tested in different regression. However, Holt’s winter method with additive seasonality came out to be the best model after multiple trial and errors. High values of Alpha and Beta helped capture the quick changing trend effectively as observed below:



Method	Sample	MAPE
Holt's Winter (additive)	Training	4.4%
	Validation	6.06%
Seasonal Naive	Validation	7.2%
Regression using exchange rate	Training	3.6%
	Validation	13%

As observed, MAPE for Holt’s winter is the best. The prediction plots and the error plots below also present the same story:

B. TRAVEL FROM REGION: NORTH AMERICA- FROM JAN 2012 – SEP 2018

Forecasting Methods	MAPE-Validation
Seasonal Naive	12.62%
Holt-Winters (with default α , β and γ)	26.63%
Linear Regression - Multiplicative Seasonality	8.93%

There is a steady increase in the NA visitors in 2019 as compared to 2018. The first 9 months contribute to 80% of the total NA visitors to UK. There is a 14% rise in the

average no. of visitors during these 9 months as compared to that of past 3 years on an average. The predictors also indicate seasonality and effect on the output. Season 7 (July) is clearly the most important travel season for the NA visitors. June-July-August are the peak months of the year. February is the duller month for the NA visitors. Overall, this is an important group of visitors given the slowdown in visitors from the European region and a steady trend.

C. TOTAL NUMBER OF VISITORS TO UK FROM JAN 2012 - SEP 2018

The given dataset was found to have a Linear Trend with $R^2 = 0.2221$; with a multiplicative seasonality.

Forecasting Methods	MAPE - Validation
Seasonal Naive	5.8%
Holt-Winters (with default α , β and γ)	11.3%
Holt- Winters (with Optimized α, β and γ)	5.73%
Linear Regression-Multiplicative Seasonality	18.27%

Naïve forecast using seasonal data fitted well because we have a dip in the trend after May 17 because of the reasons mentioned in the executive summary. Further Holt's winter method was used because we have both seasonality and

trend. Since we have a local trend in the data, we increased the value of alpha and beta so that the software can learn it faster. We added extra dummy variable for Brexit and one interaction term in the regression model. However, the least MAPE was still found in the Holts Winter's method ($\alpha = 0.4$, $\beta = 0.35$) which was then used for the forecasting.

D. TRAVEL PURPOSE: VISITING FRIENDS/RELATIVES FROM JAN2012 - SEP 2018

The given dataset was found to have a Linear Trend with $R^2 = 0.3491$; with a multiplicative seasonality.

Forecasting Methods	MAPE- Validation
Naive	13%
Seasonal Naive	5.36%
Holt-Winters (with default α , β and γ)	8.45%
Linear Regression - Multiplicative Seasonality	5.74%

Starting with Naïve forecast, we used Seasonal Naïve, Holt-Winters and Linear Regression on the given dataset. As shown in the table below, the least MAPE was found to be for

Linear Regression method considering Multiplicative Seasonality and this output was used to forecast the series for next one year.

E. TRAVEL PURPOSE: HOLIDAY FROM JAN2012 - SEP 2018

The given dataset was found to have a Linear Trend with $R^2 = 0.0866$; with a multiplicative seasonality.

Forecasting Methods	MAPE -Validation
Naïve Forecast	26.04%
Seasonal Naive	8.86%
Holt-Winters (with default α , β and γ)	23.02%
Holt- Winters (with Optimized α , β and γ)	12.054%
Linear Regression- Multiplicative Seasonality	8.54%

Starting with Naïve forecast, we used Seasonal Naïve, Holt-Winters and Linear Regression on the given dataset. As shown in the table below, the least MAPE was found to be for Linear

Regression method considering Multiplicative Seasonality and this output was used to forecast the Holiday data series for one year.

F. TRAVEL PURPOSE: BUSINESS FROM JAN2012 - SEP 2018

The given dataset was found to have a Linear Trend with $R^2 = 0.1206$; with a multiplicative seasonality.

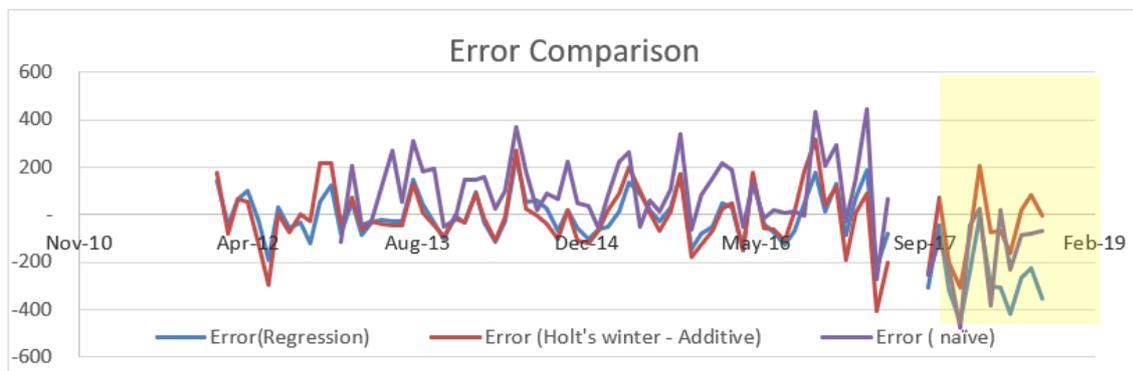
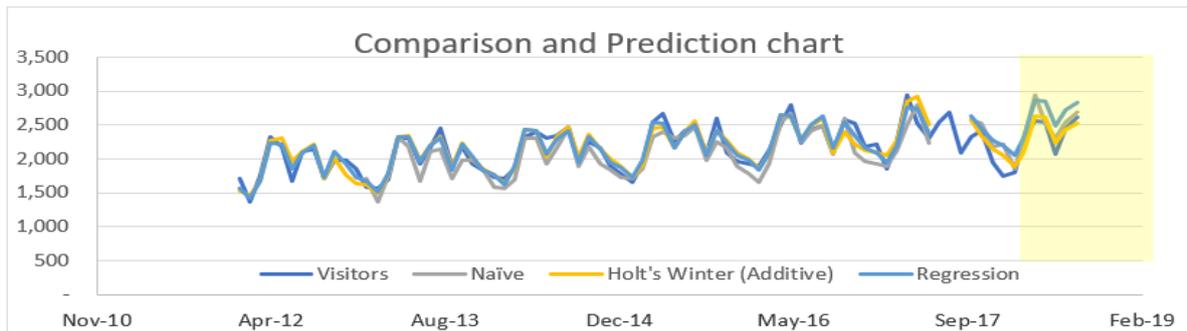
Forecasting Methods	MAPE -Validation
Naïve Forecast	19.88%
Seasonal Naive	17.89%
Holt-Winters (with default α , β and γ)	13.73%
Holt- Winters (with Optimized α , β and γ)	10.84%
Linear Regression- Multiplicative Seasonality	6.16%

Starting with Naïve forecast, we used Seasonal Naïve, Holt-Winters and Linear Regression on the given dataset. As shown in the table below, the least MAPE was found to be for

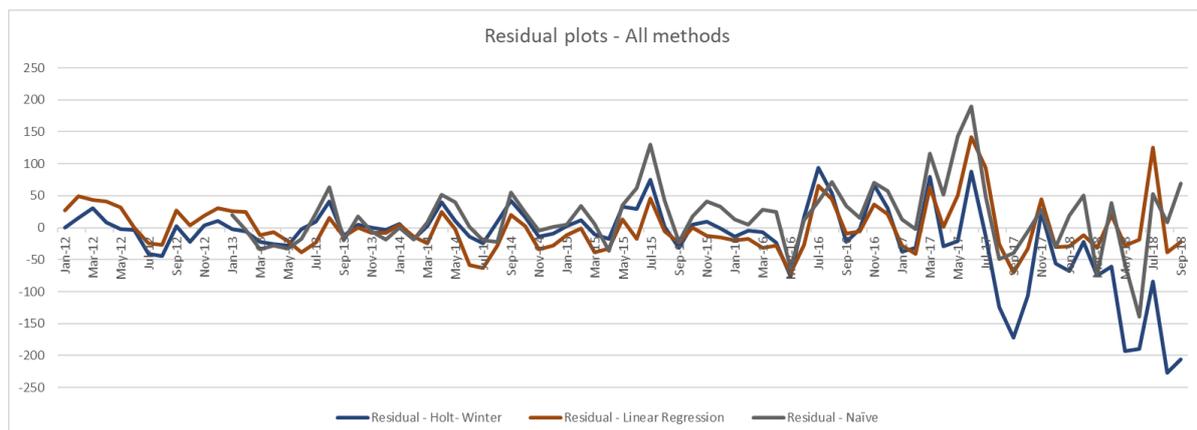
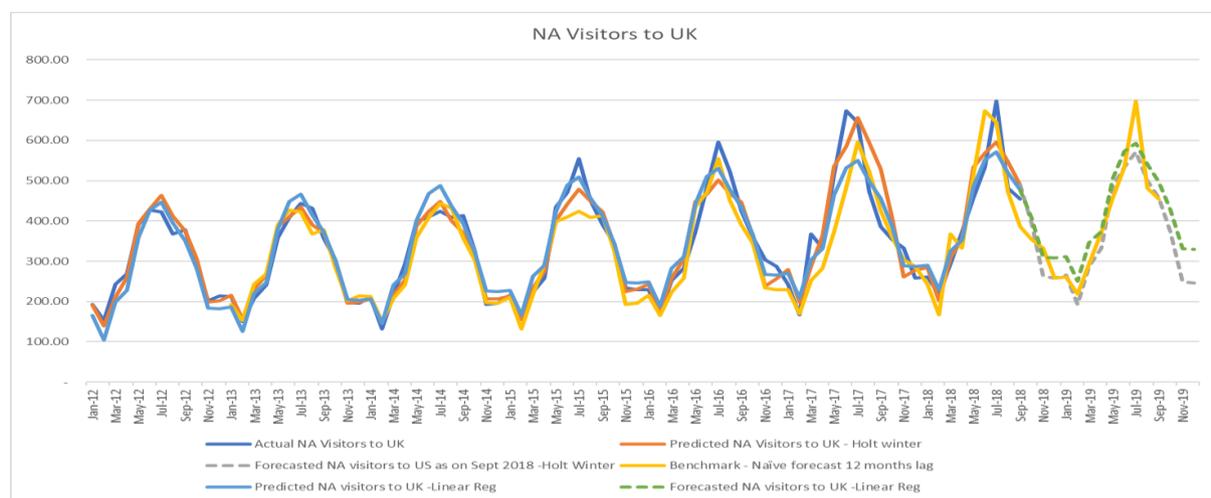
Linear Regression method considering Multiplicative Seasonality and this output was used to forecast the Holiday data series for one year.

APPENDIX

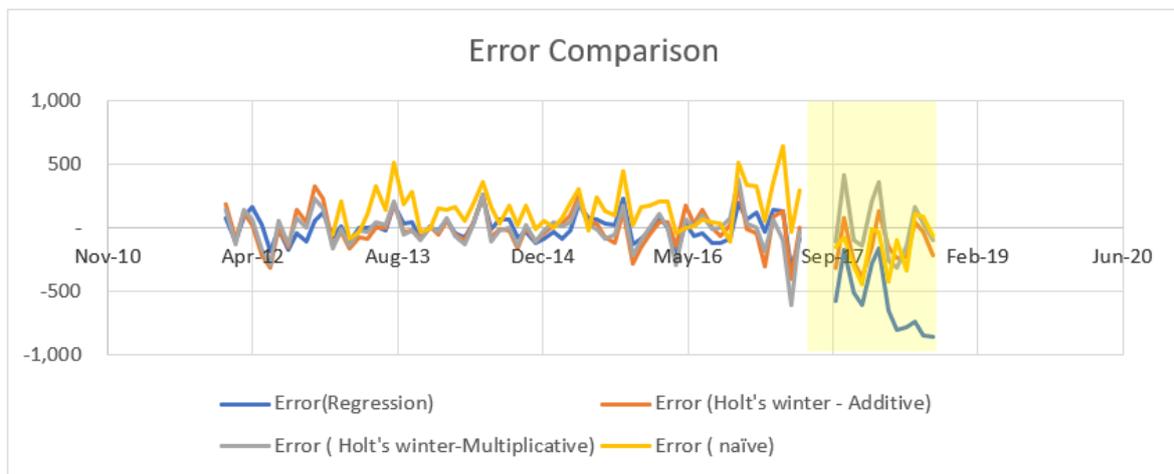
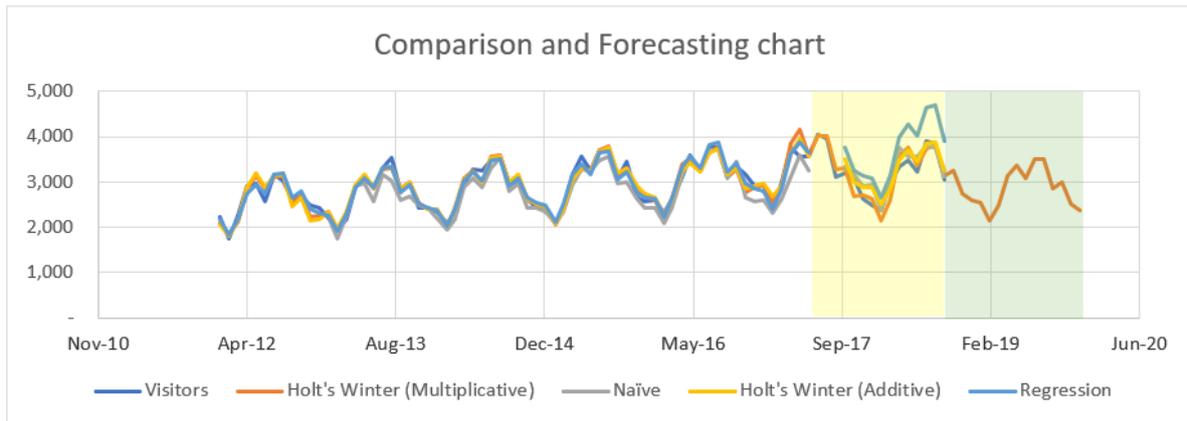
A. TRAVEL FROM REGION: EUROPE - FROM JAN 2012 – SEP 2018



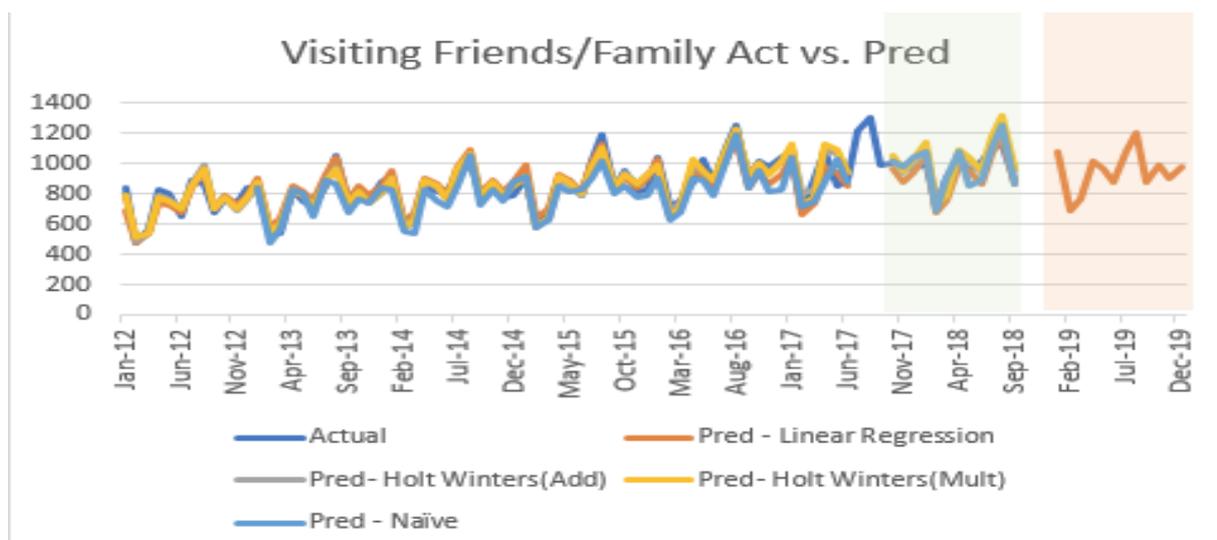
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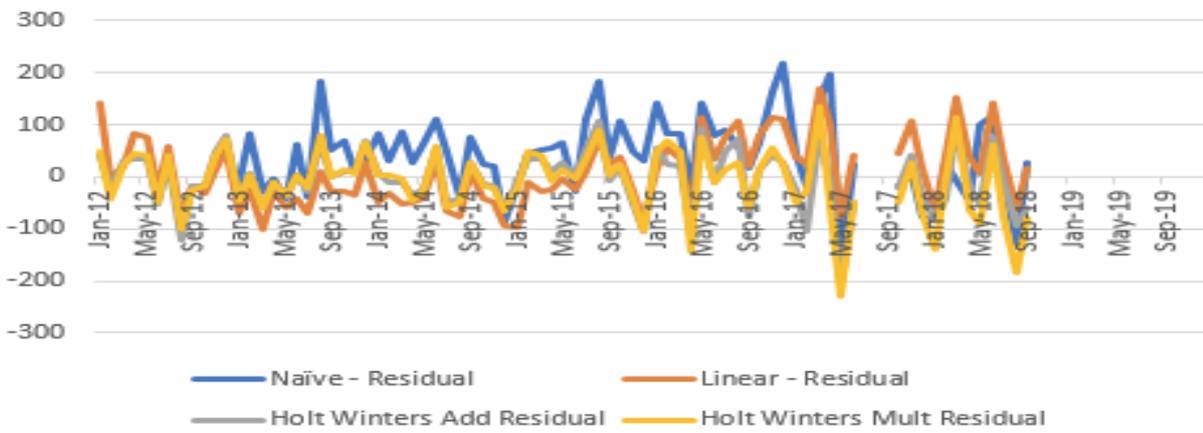
C. TOTAL NUMBER OF VISITORS TO UK FROM JAN 2012 - SEP 2018



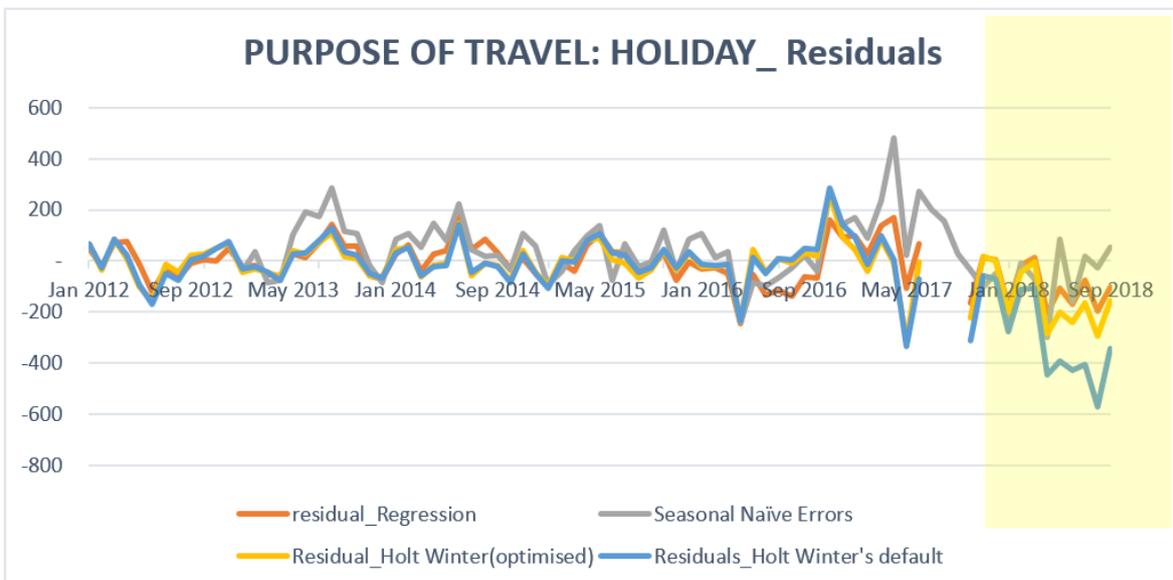
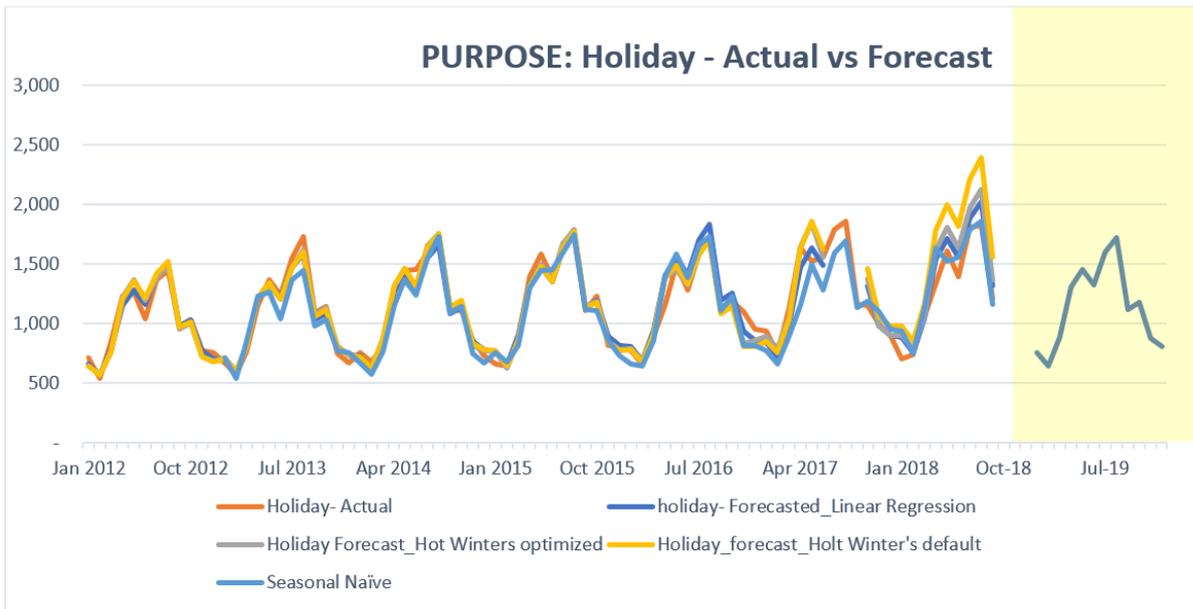
D. TRAVEL PURPOSE: VISITING FRIENDS/RELATIVES FROM JAN2012 - SEP 2018



Visiting Friends/Family - Residuals

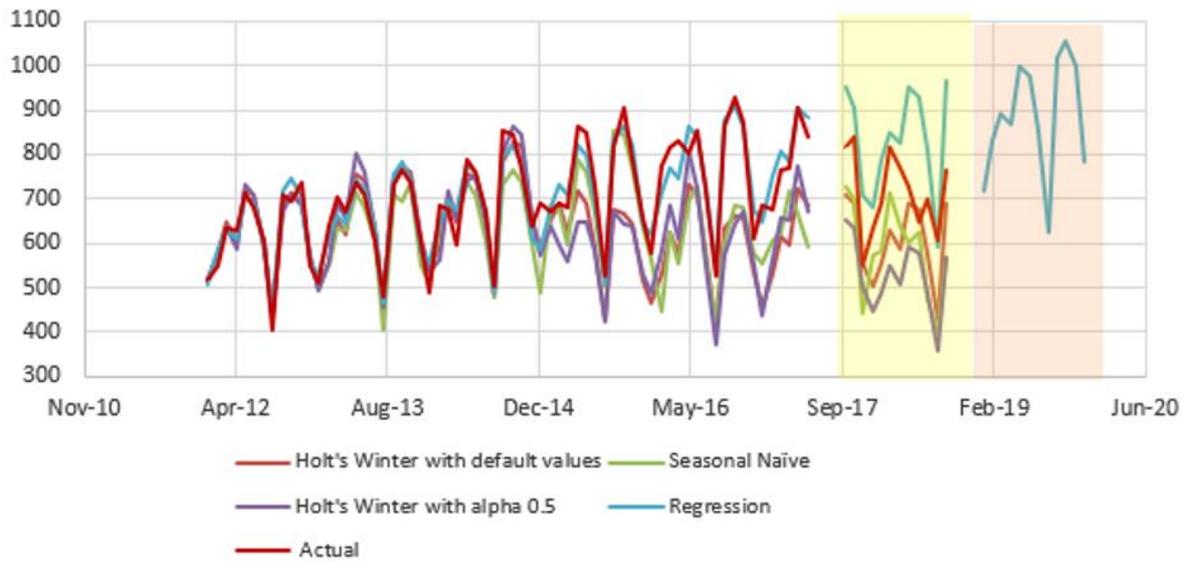


E. TRAVEL PURPOSE: HOLIDAY FROM JAN2012 - SEP 2018



F. TRAVEL PURPOSE: BUSINESS FROM JAN2012 - SEP 2018

Business Travelers: Comparison and Forecasting chart



Business Traveler: Error Comparison

