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1. Introduction

Bristol, as one of the 'Core Cities' in Great Britain, has a large potential in tourism and accommodation industry. The number of inbound tourists for 'staying visits' in Bristol have increased by around 58.6% from 377 thousand in 2010 to 598 thousand in 2018 (Inbound town data, 2019) while the number of university students, as Bristol City Council stated, has increased by 18% (8300) from 2013/2014 to 2018/2019 academic year (The Population of Bristol, 2020). This report will provide analytics insights in the rental market in Bristol based on the data from Airbnb and give recommendations accordingly for constructing competitive services against Airbnb.

2. Analysis

In this report, it has analysed the rental market in Bristol from four aspects which are,

I. Trend and Seasonality Analysis

This part of the report looks at the trend of demand and supply for Airbnb rental houses in Bristol while it also looks at the seasonality for the demand and proposes a possible reason for having that kind of seasonality.

To accomplish that, it collects the meta data 'id' (the id of the rental house) and 'reviews_per_month' (the number of average reviews a house receives in a month) from 23 monthly updated listing files in insideairbnb (Inside Airbnb. Adding data to the debate., 2020) and integrates them as two sets of time series for demand and supply, respectively. To predict these two factors, the time series are plotted with the 12-month forecasts by using ARIMA(0,1,0)(0,1,0) model.

After that, to analyse the seasonality of demand, it decomposes the time series for reviews (note that, the data in June of 2018 is missing, therefore in order to finish the decomposition, the data in May of 2018 is replicated for June) with the 'decompose' function in R package 'stats'. By comparing the result of decomposition with the number of oversea visitors to UK in the last decade from Office of National Statistics (ONS) (OS visits to UK:All visits Thousands-NSA - Office for National Statistics, 2020), it justifies the relation between the rental market and the tourism industry.

II. Price and Location Analysis

This part is aiming to analyse the market gap for houses with various price levels in each neighbourhood by looking at the distribution and densities of house resources.

To have some general information, a descriptive statistics and a quartile calculation for the 'price' data (the daily fee) have firstly been applied to get the general information such as the minimum, maximum, mean and median of the rental prices in Bristol. According to the quartiles, all the listings are categorized into five groups with different price ranges (the criteria of grouping can be seen in Appendix 5). Then, a box chart (that contains the price distributions in each neighbourhood) and two stack graphs (that present the supply and demand for houses with different price level) have been drawn. Meanwhile, a geographic map, which reveals the location of all the rental resources, has also been generated to demonstrate the densities of houses.

III. Bed Types Analysis

This part focuses on finding out the market gap for different types of beds.

The data that have been used in this part are ‘id’(count as the number of houses), ‘reviews_per_month’(average as the popularity) and ‘bed_type’(the type of bed the house has).

To analyse the bed type, it calculates the average of ‘reviews_per_month’ as the popularity and counts the number of ‘id’ as the number of suppliers for each bed type. Then, these two factors are compared in a bar chart to find the type with high popularity and less supply. After that, it plots a time series for the popularity of each bed type in the latest 21 months to figure out the tendency of popularity and combine the result with the bar chart to find a bed type with highest potential market.

IV. Correlation Analysis on Services Factors

In order to find the services factors that may have impact on the popularity of a house resources (the number of reviews it receives) without considering the price and location, this report lists four potential factors (Cancellation policy, Cleaning fee, Host response time and Host response rate). To determine which are the key factors, a correlation matrix has been created by using the ‘cor’ function in R with the Airbnb data updated in March of 2020.

As the ‘cor’ function only take numeric values, a data transformation is applied to ‘Cancellation Policy’ and ‘Host Response Time’ columns in the raw dataset to transform the them from characters to numeric values before generating the matrix (the transform criteria can be seen in Appendix 6).

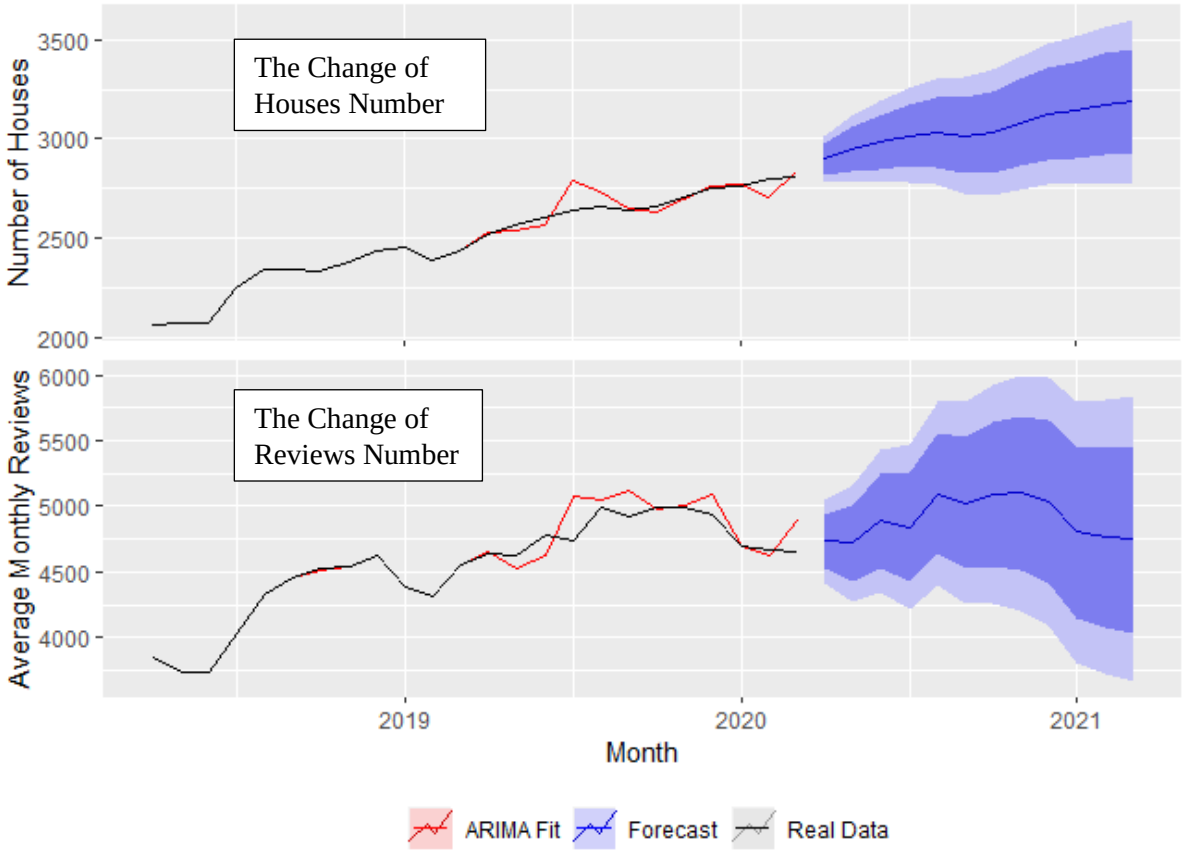
At the end of this part, a bar chart is plotted to further demonstrate the impact of the key factors have on the number of the received reviews.

3. Results and conclusions

Trend and Seasonality

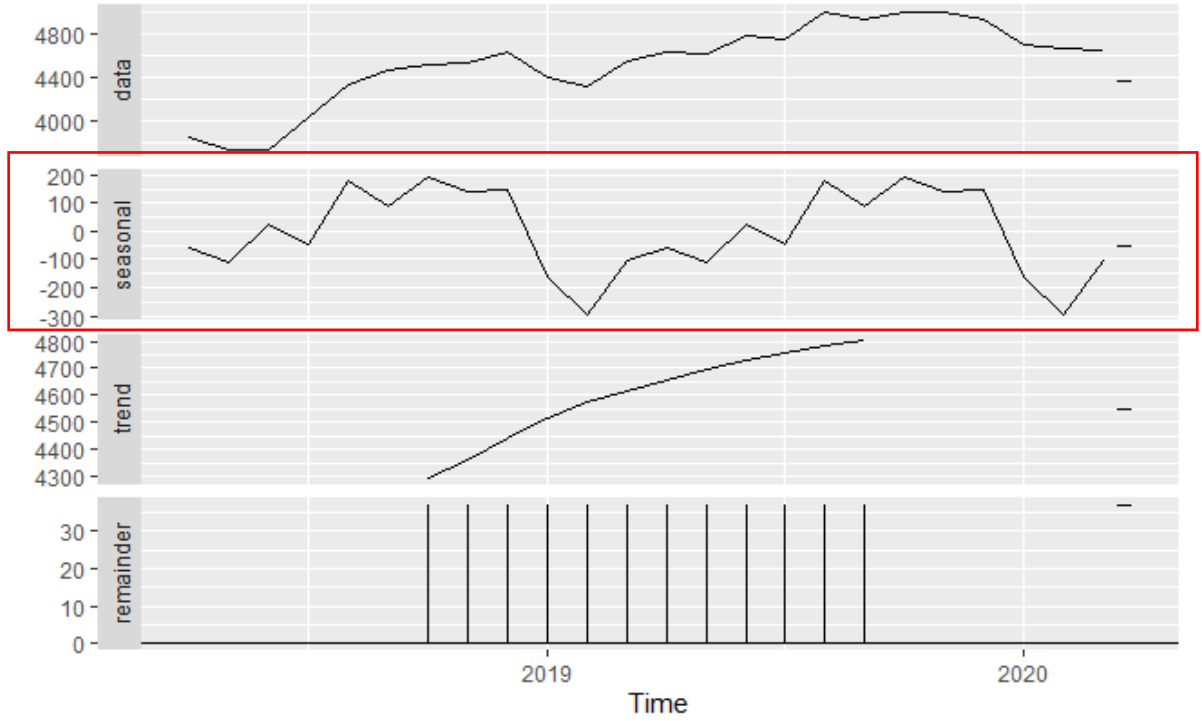
From the first chart in Figure 2.1.1 which shows the number of rental houses from July of 2018 to March of 2020, it can be seen that although there were some slight fluctuations in the process, the number of registered Airbnb houses has increased by 24.8% from 2250 to 2810 in Bristol. However, the change of monthly reviews (the second line chart) is much more fluctuating and seasonal.

Figure 2.1.1: The Change of Houses and Reviews in Bristol



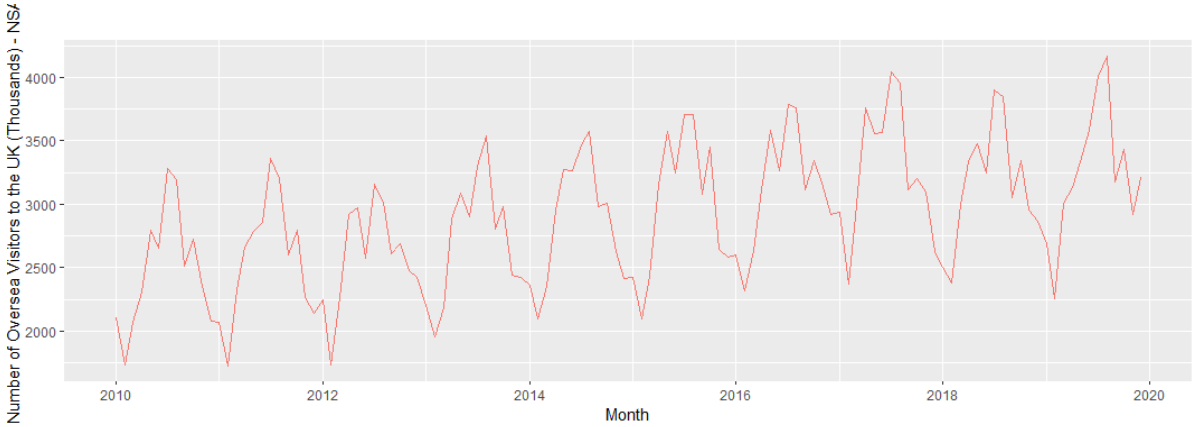
The highlighted subgraph in decomposition figure below reveals that with some reasonable fluctuation, the number of reviews increase from February to November while after December, this number faces a dramatic and abnormal drop until the next February. In order to figure out the reason for this drop, the same time series of monthly reviews in London and Greater Manchester have also been analysed. The result (see the result in Appendix 1 - 4) shows that in both London and Greater Manchester, the numbers of monthly reviews also face a similar drop only with a slight difference in time.

Figure 2.1.2: The Decomposition of the Change of Reviews in Bristol



This kind of drop is very likely related to the seasonality of tourism industry in UK. From Figure 2.1.3, which was generated based on the data of oversea visitors to UK from ONS (OS visits to UK:All visits Thousands-NSA - Office for National Statistics, 2020), we can see a clear pattern that is the number of tourists in winter season is much smaller than that in other seasons. Comparing with the seasonality of reviews, this pattern shows a high correlation to the drop of demand for rental houses in Bristol.

Figure 2.1.3: Oversea Visitors to UK from 2010 to 2019



The forecasts in Figure 2.1.1 indicates that both the demand and supply for rental houses will face an increase in the next 12 months. However, considering the effects of COVID-19, this demand probably will be heavily impacted, consequently, it may see a significant drop in 2020.

To conclude, the occur of COVID-19 may impact the increasing trend of both demand and supply for rental market in Bristol. In the common situations, the demand peaks in summer season while in winter season it drops significantly, which is very likely related to the trough of overall tourism industry of UK. With understanding the trend and seasonality of the rental market, it is beneficial for our company to adjust the policies in the future for different seasons.

Price and Location

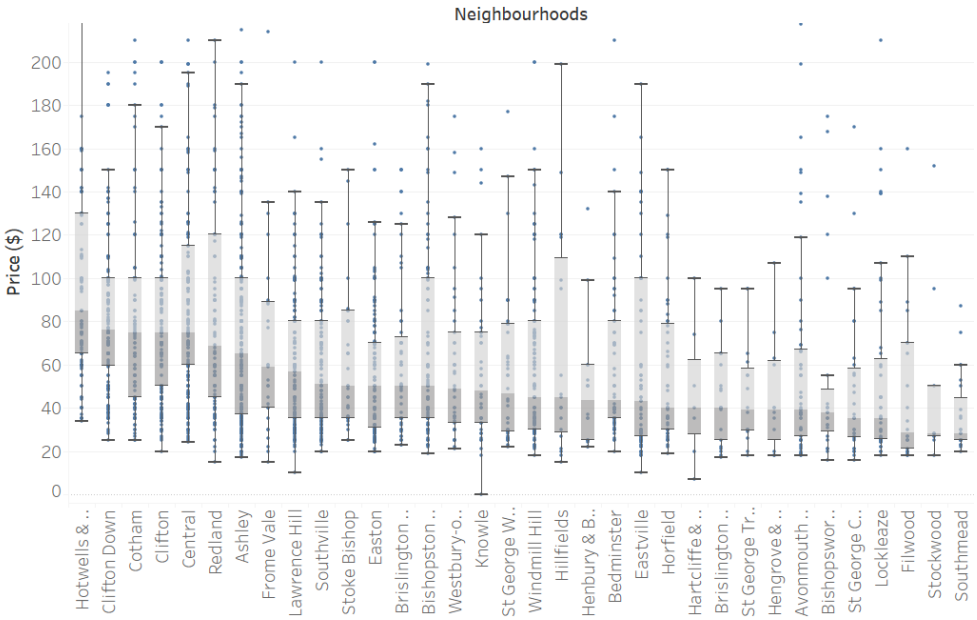
Table 2.2.1 shows that the minimum and maximum prices of Airbnb houses in Bristol are $7 and $1600 while the average price is $82.5. Q1 and Q3 indicate that the rental prices for most of the houses are distributed between $36 and $95.

Table 2.2.1: Descriptive Statistics of Price

price	
Mean	82.471
Standard Error	1.711
Median	60
Mode	35
Standard Deviation	90.670
Sample Variance	8221.028
Kurtosis	50.402
Skewness	5.545
Range	1593
Minimum	7
Maximum	1600
Sum	231660
Count	2809
Confidence Level(95.0%)	3.354
Lower Quartile(Q1)	36
Upper Quartile(Q3)	95
Upper Whisker	182

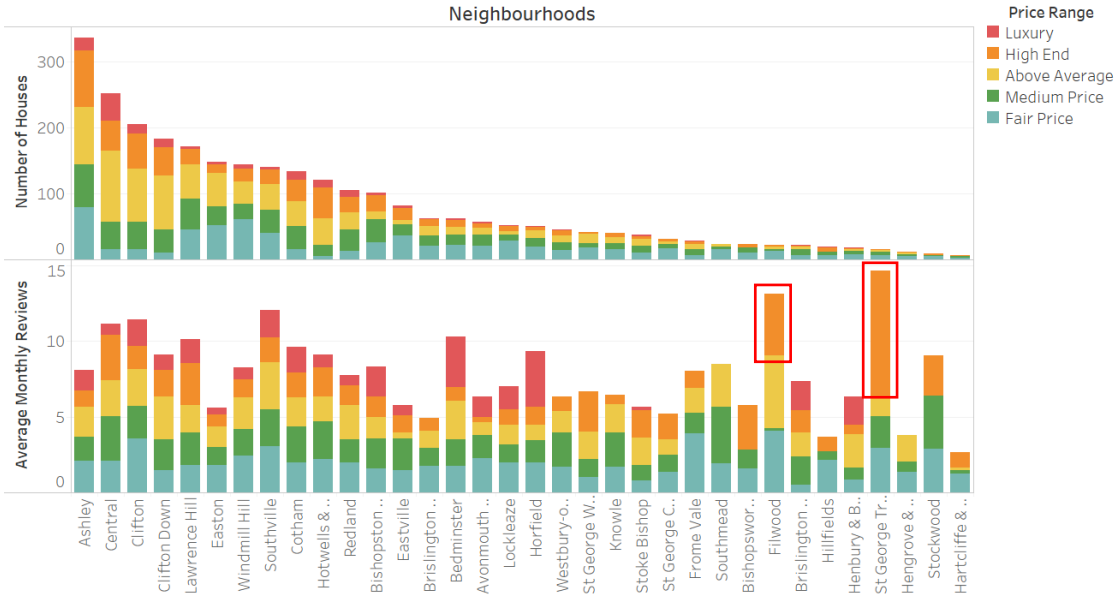
Figure 2.2.1 shows that Hotwells & Harbourside, Clifton Down and Cotham are the top three neighbourhoods with the most expensive rental resources while in Filwood, Stockwood and Southmead, the cost is relatively lower. Additionally, the rental prices in neighbourhoods like Bishopsworth and Stockwood are narrowly distributed, which implies that the market in these areas has not been thoroughly developed as there is no costly houses.

Figure 2.2.1: The Price distribution in each Neighbourhoods



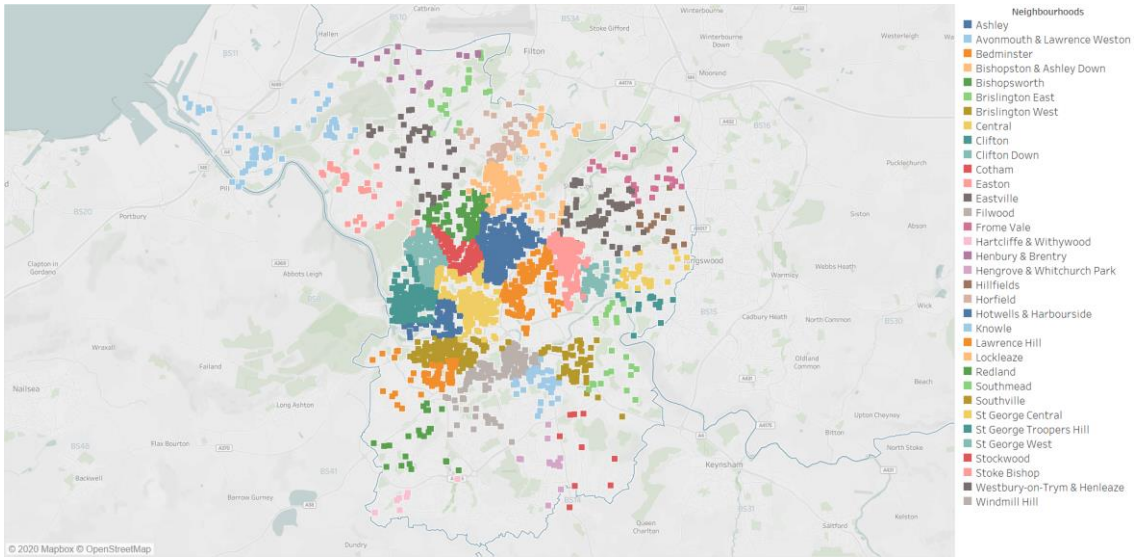
The two stack charts in Figure 2.2.2 presents the number of houses with different price ranges in each neighbourhood and the quantity of average reviews they received. By comparing these two charts, we can see that rental markets in neighbourhoods like Ashley, Central and Clifton are more mature as they have resources in all price levels and received corresponding quantity of reviews. Whereas, in Filwood and St George Troopers Hill, there is a large part of reviews are assigned to high-end houses, which implies that visitors are willing to pay money to enjoy their life, while there is no luxury level of houses. Thus, the market in these two areas may have a gap for luxury rentals.

Figure 2.2.2: The Demand and Supply in Different Price Range



To summarize, combining the geographic map below, we can know that the rental prices, densities and quantity of house resources around the Central, especially in Ashely, Clifton and Lawrence Hill, are much higher than that in suburbs. Meanwhile, A potential market gap for luxury accommodations may occur in areas that have not been comprehensively developed. Based on this discovery, our company can adjust the investment direction and focus more on the market in suburbs.

Figure 2.2.3: The Geographic Distribution of Houses



Bed Types

Airbnb in Bristol offers 4 types of beds for customers to choose. In the four types (Airbnb originally has 5 types of beds, however, the type Couch has no longer been available, thus, in this analysis it will only consider the left four types), according to Figure 2.3.1, the majority houses have real beds while those with Airbed and Pull-out Sofa receive more reviews than average. This may result from too many houses with real beds, which shares the customers who want this type of houses, in other words, the competition among these houses are fiercer.

Figure 2.3.1: The Reviews and Number of Houses with Bed Types

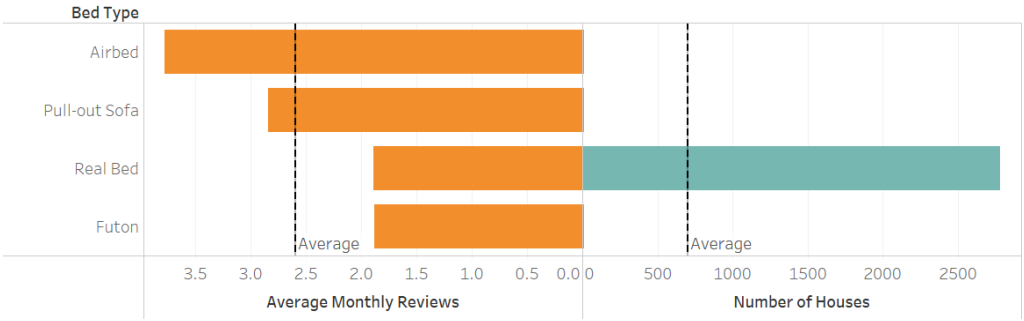
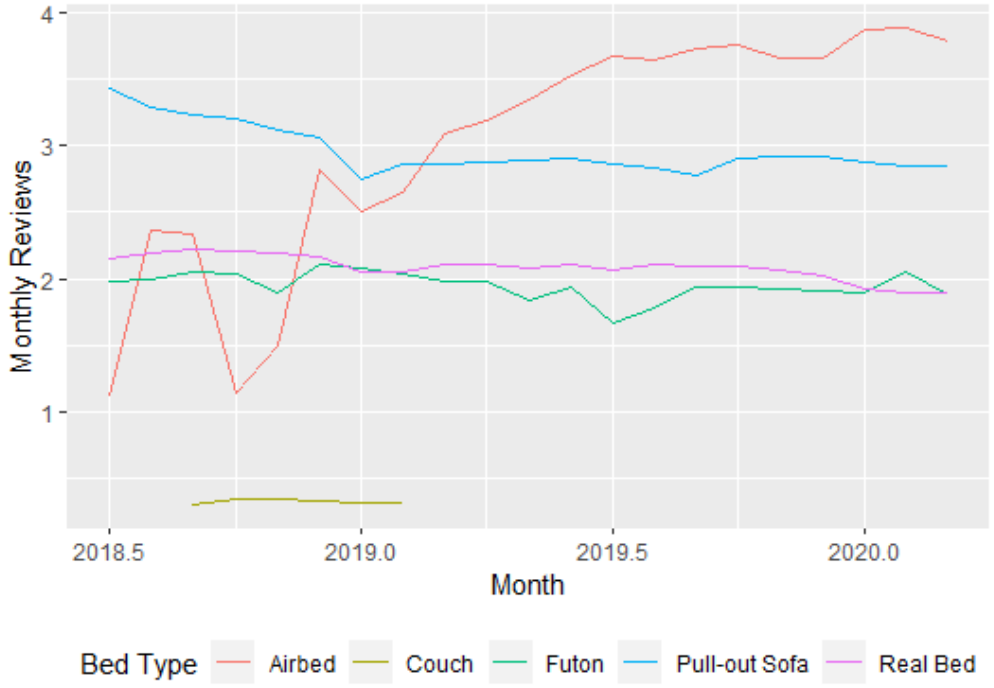


Figure 2.3.2, which is a time series from July of 2018 to March of 2020, shows that only the houses with Airbed has a tendency of having more reviews. This indicates that if the trend continues, the houses with Airbed may get more popular soon, which can be seen as a potential market gap.

Figure 2.3.2: The Time Series of Monthly Reviews with Bed Types



To conclude, although in the Bristol market houses with read beds is the mainstream, the competition among them is much fiercer than those with Airbed and Pull-out Sofa. Also, considering the tendency of popularity, investing accommodations with Airbeds seems to be a more profitable choice for our company.

Correlation

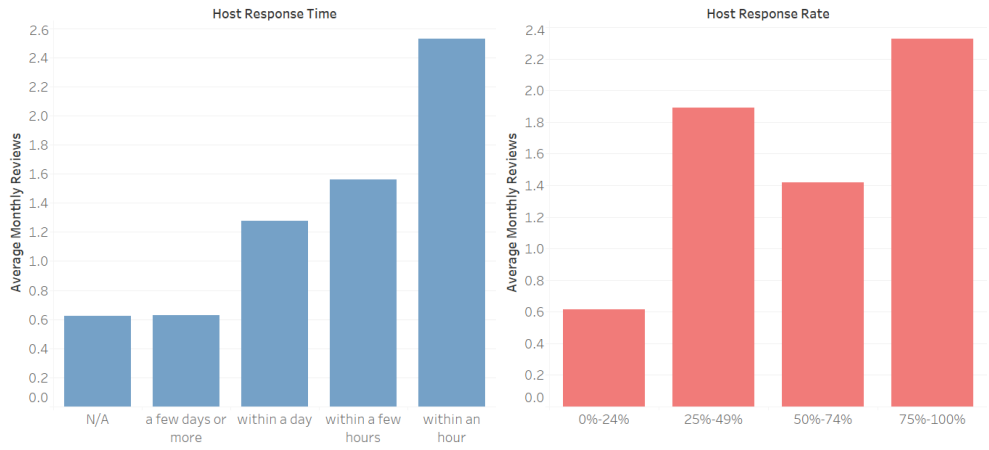
From Table 2.4.1, it shows that among these four factors, Host response time and Host response rate have a relatively higher correlation with Monthly Reviews which implies that the speed and rate of host responses have large contributions to the number of reviews received.

Table 2.4.1: The Correlation Table

	Monthly Reviews	Cancellation policy	Cleaning fee	Host response time	Host response rate
Monthly Reviews	1.000	-0.137	0.095	0.460	0.448
Cancellation policy	-0.137	1.000	-0.338	-0.230	-0.158
Cleaning fee	0.095	-0.338	1.000	0.215	0.132
Host response time	0.460	-0.230	0.215	1.000	0.784
Host response rate	0.448	-0.158	0.132	0.784	1.000

Figure 2.4.1 shows how much reviews can be received with different response time and response rates. In this figure, the increase of average monthly reviews is clearly positively connected to the response speed of hosts. As for the response rate, although the value for the range between 25%-49% is higher than that for 50%-74%, the overall trend of received reviews is still going up as the response rate goes higher.

Figure 2.4.1: The Impact of Response Time and Rate



To summarize, the higher rate hosts response and the less time spent will increase the number of reviews received.

4. Recommendations

According to the above analysis, a list of four corresponding recommendation is as follow:

I. The COVID-19 may seriously impact the rental market in Bristol, thus, investments in 2020 should be more carefully. Without considering that and merely based on the result in seasonality analysis, we should add more advertisements on the market in advance before summer season to stimulate visitors to consume on our platform and when it reaches the winter season, we can lower our price and seek for cooperation with other organisations, for example, renting our idle houses in a lower price to other companies for team building activities or cooperating with programmes like ERASMUS to offer exchange students our idle resources as accommodations.

II. As neighbourhoods like Filwood and St George Troopers Hill have active reaction for the high-end accommodations, we can add some luxury level of rentals to fit the market gap.

III. The result of bed type analysis suggests that there is an evident increasing demand for Airbed. Therefore, we can either increase investment on houses with this bed or add this as an extra service to attract customers.

IV. According to the correlation analysis, in order to have more reviews, we can set a punishment or reward system in order to improve hosts' response speed and rate.

5. References

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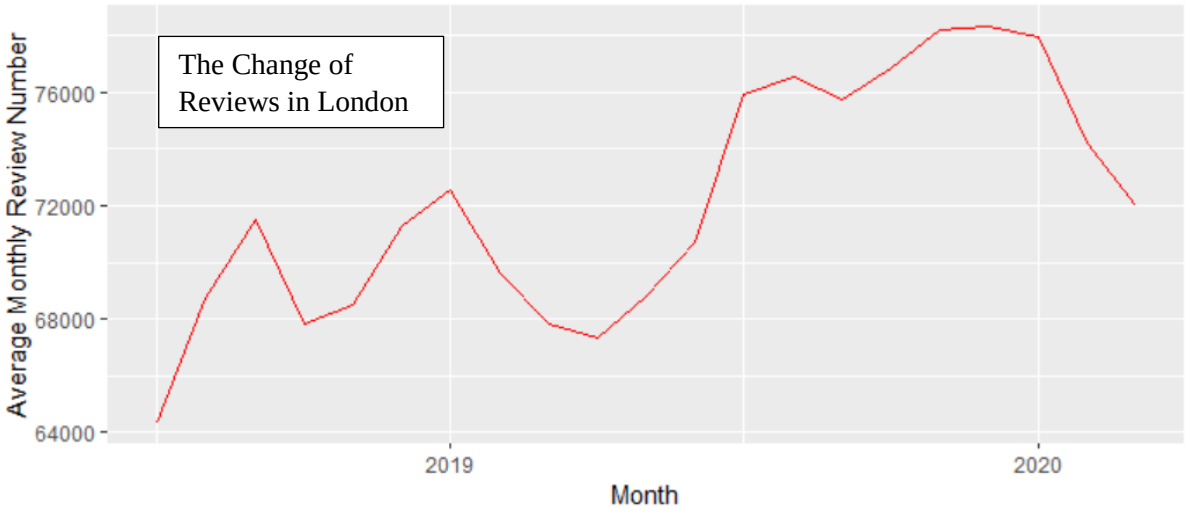
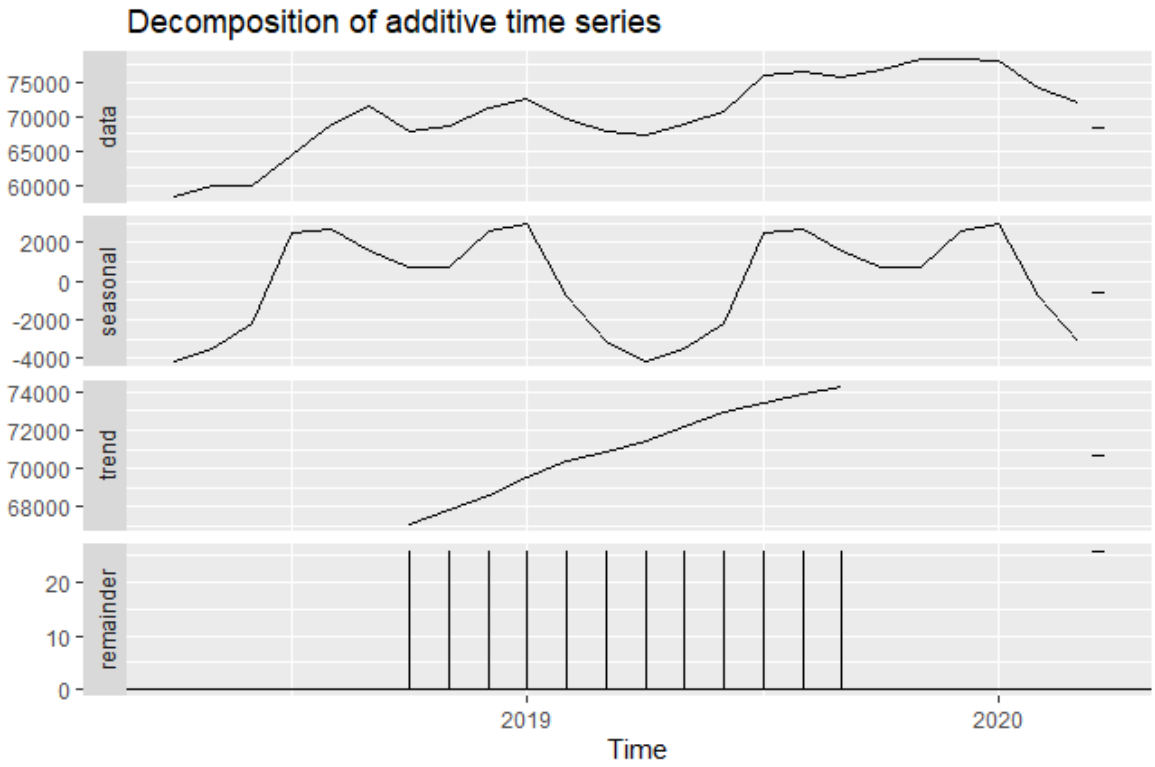
6. Appendix

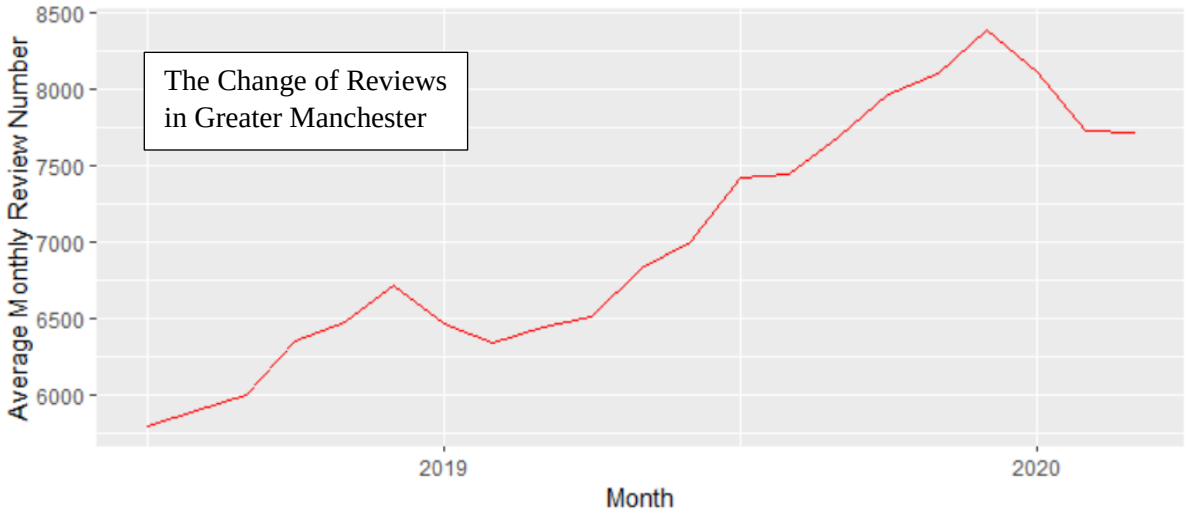
Appendix 1: The Change of Monthly Reviews in London



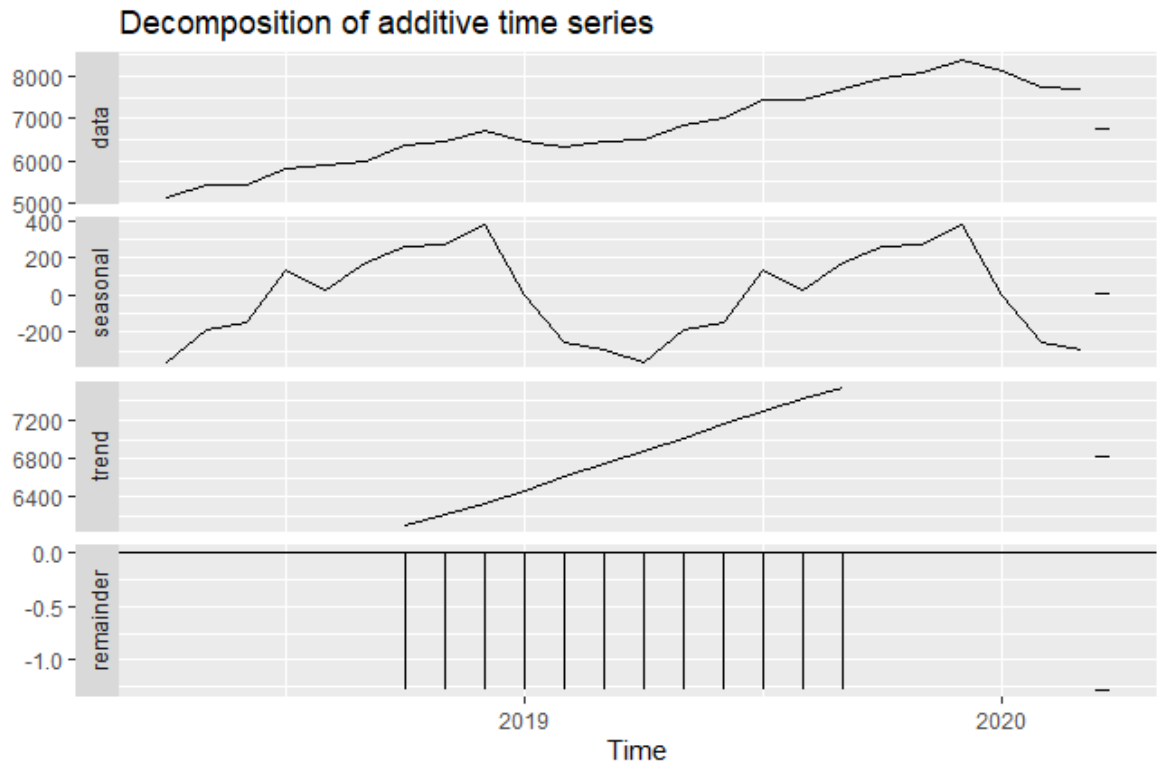
Appendix 2: The Decomposition of the Change of Reviews in London



Appendix 3: The Change of Monthly Reviews in Greater Manchester



Appendix 4: The Decomposition of the Change of Reviews in Greater Manchester



Appendix 5: The Criteria of Grouping Prices

Price Range	Tag	Criteria
0-35	Fair Price	Lower Hinge
36-59	Medium Price	Median
60-94	Above Average	Upper Hinge
95-181	High End	Upper Whisker
182 +	Luxury	Over Upper Whisker

Appendix 6: The Criteria of Transforming Cancellation Policy and Host Response Time

Cancellation Policy

Original Value	Assigned Value
'strict_14_with_grace_period'	1
'super_strict_30'	2
'super_strict_60'	3
'moderate'	4
'flexible'	5

Host Response Time

Original Value	Assigned Value
'N/A'	1
'a few days or more'	2
'within a day'	3
'within a few hours'	4
'within an hour'	5