

INSY 442: Business Intelligence and Data Analytics
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Marriott International: A Data Analysis

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Executive Summary

The global hotel industry is a high revenue industry that has many threats going against it despite the low concentration in competition. The focus of the research is around Marriott International, one of the key and global leaders in the industry.

Marriott International made \$20.97 Billion USD in revenue in 2019, operating 7,349 hotels worldwide (Statista, 2019). They are highly threatened by new players in the industry like Airbnb and are prone to risks based on the global health of the economy; something that is important in light of the recent COVID-9 pandemic.

In this data analytics report, we study the distribution of the hotel demand details and propose a variety of recommendations to cut costs and improve liquidity as hard times are ahead for the industry. Moreover, we expand on key influencers that affect the cancellation rate of hotels to again reduce the expenses of the industry but also to increase its revenue. Finally, we find the best way to implement marketing campaigns and utilize the marketing budget of the hotel chain.

Key insights that you will read about in this report include how hotels should target the right customer segment at any point in time, which months are the top revenue earners and what food supply is ideal. Also, we explain how the deposit type requested before a reservation has the greatest impact on room cancellation. This result from a prediction model developed in PowerBi. A lot more recommendations are presented in this report aiming to get the Marriott International back on its feet as fast as possible.

Overview of the Hotel Industry

The hotel industry has always been an important staple in tourism and the workplace. Whether one is travelling for leisure or work, hotels or rented stays are almost always a required service purchase to make.

From 2014 to 2018, the global hotel industry brought in over \$2.7 trillion USD (Statista, 2019), with \$600 billion in 2018 alone. In 2019, the US Hotel Industry alone brought in \$200 billion (Statista, 2019). From 2014-2018 the industry experienced a growth rate of 13.1% (Statista, 2019). However, the industry in the US has been forecasted to have lower growth rates in 2020-2024 than the previous years, hovering around 2% per year (IBISWorld, 2019).

Still, the industry is also highly susceptible to the overall health of the economy and the need for leisure among consumer segments. With the global pandemic of Coronavirus that started the new year, the industry is already experiencing lots of trouble. Not only are people not travelling, many countries are banning travel all together. The purchasing of travel tickets and hotel rooms are complementary goods. With this there has already been forecasted growth rates for the industry in the US and Canada for 2020; 2.48% (down from 3.64%) and -5.37% (down from -0.51%), respectively (IBISWorld, 2019). It is important to note that these are forecasts for the current time horizon of the coronavirus, which may or may not be further extended. The more troubling issue at hand is that travel in general will likely experience a decrease even after COVID-19, further increasing the toll on the industry. This can overall hurt one of the industry's strengths, low volatility.

Another weakness that may become a problem under troubling macroeconomic effects is the fact that the players in the industry have high capital requirements. This capital, mostly taking up the actual buildings and real estate that the companies own, have to be maintained and paid for in the form of mortgages or credit-line repayments. When revenues are not as they should be, these assets can be hard to afford. These high capital requirements are also part of the barriers to entry in the industry. It is estimated that the cost to build a hotel ranges from \$100,404 to \$753,433 per room depending on how luxurious it is (IBISWorld, 2019). This barrier effectively reduces the amount of competitors that can enter the market. Currently, while the competition is high in the industry, the concentration of it is low, with effectively only major players competing with each other.

Over the last couple of years, the industry has seen a threat from alternative stays. Most notably, AirBnB which offers guests an option to rent out homes, apartments, condominium units, and even experiences. What makes a company like AirBnB revolutionary is that it eliminates the high capital requirements. Now any individual can register their own real estate and make revenue from it. One thing that may limit the growth of this competitor is that the average daily rate is higher than that of hotel rates in the US, \$173 against \$130 in 2018 (Statista, 2019). However, it seems that in major cities, the cost of AirBnB rentals are often less on average (Stanton, 2019). In 2018, AirBnB had a big impact in the US stays industry, pulling in \$33.8 billion USD with 164.3 million guests in 2018 (Statista, 2019). AirBnB often serves as

unique and dynamic options when compared to traditional hotels, which may lead customers to booking them over the classic option. Currently, the generation which will begin travelling more, Millennials, have only found themselves booking traditional occupancies 58% of the time (Gilliland, 2017).

Through the advent of online bookings over the last ten years, the major companies in the competitive space have had trouble raising their prices over the years due to the transparency of rental websites like Expedia and Booking.com. On these websites, hotel rooms are directly competing with one another largely based on price, with many options available to the customers at the touch of their fingers. This has ultimately led to hotel chains finding ways to differentiate their brands and advertise better offerings than one another.

With online listings and the growth of AirBnb, it can be argued that hotels must find ways to increase their advertising effectively and to the right segments to achieve substantial growth in light of the low projected year to year annual growth rates that they will face. Moreover every cut in cost is welcome by the industry to improve liquidity.

Overview of Marriott International

Marriott International is a hotel company based out of the U.S. They are considered one of the major players in their respective industry. The company operates in North America, Asia Pacific, Europe, Middle East and Africa, and the Caribbean and Latin America. They hold a brand value of \$5.04 billion worldwide (only behind Hilton) and were the highest performing hotel company in 2018 in terms of revenue with \$20.8 billion, Hilton in second place with \$8.9 billion (Statista, 2019).

As of June 2019, Marriott operated 7,003 properties with 1.3 million guestrooms available to clients all over the globe. In 2019, their occupancy rate in North America was 75.8% (Statista, 2019).

Like many other companies in the space, Marriott has been susceptible to competition not only between competing hotel companies, but new developments like AirBnb rentals. To combat capturing millennials and staying relevant in the online space, Marriott has implemented several strategies. In 2017, they launched a series of episodes led by online influencers that took them through their travels with Marriott hotels and concept hotels (notably *Moxy*) (Gilliland, 2017). The series was meant to be authentic and inviting to millennials. The episodes were easily placed in Snapchat, YouTube and Instagram, which captured the eyes of the targeted demographic, much of which are not booking that heavily with Marriott.

Another strategy they have implemented is their use of user generated content on the social media platform for *Marriott International* (@marriottintl, 2020). The use of this content often feels more authentic and resonates with many customers on social media which are looking for transparency.

Much of these strategies they are implementing are geared towards the millennials target segment as much of them are moving towards AirBnb. Currently, much of AirBnb's guests are

younger than Marriott's, with 49% of them being Millennials compared to 28% at Marriott (Stanton, 2019). The focus on millennials is important as their choice may have strong economic effects on the industry as they get older and grow into their careers which may involve travel.

Overview of Business Insights

Customer Segmentation

First, management requests us to detail the customer segmentation at any given point in time in order to understand the distribution of reservations in detail. In other words, he would like to understand where his clients are coming from and what do they request the most so that he can be prepared and also target the right customers when advertising.

Seasonality and Cost Reduction

Second, management requests us to identify demand seasonality to adequately staff resorts and hotels for cost reduction purposes.

Cancellations

Finally, because booking cancellation has cost the hotel industry and Marriott Hotels a lot of money historically, management requests us to utilize our analytics abilities and gain insights to predict if a reservation will get cancelled. This will lead to more accurate revenue and room availability forecast.

Data Acquisition and Techniques

Database Search

Unfortunately direct access to Marriott International Hotel chains was not available on the web or provided to us. However, management agreed to conduct research based on a database of the industry in general as they are aware that these are industry wide problems. Therefore, our analytics team was able to find a database online that covered over 120,000 booking records with 33 details per reservation from the article Data in Brief in the journal Data in brief by NunoAntonio, Anade Almeida and LuisNunes. Those details included the time of the reservation, the number of adults and babies, the deposit type to mention a few. The full database variables and the set of databases merged can be found in the link provided in the reference section of this paper.

Data Manipulation

To get the data ready for analysis a few transformations were required. First, we had to merge all databases together by a series of inner join functions. Then, we had to edit the format of some variables to implement them seamlessly in Tableau. For example, the date variable was originally divided into 3 distinct variables, namely: "arrival_date_year", "arrival_date_month" and "arrival_date_day_of month". Using excel we were able to join these three columns using

the function “=date()”. Next, to conceptualize our analysis we decided to cover trends over a single year to limit external forces that could impact the industry demand. We chose to cover the year 2016 as it is one of the most recent years in the dataset and also has the most data available.

Data Quality and relevance

In terms of the quality and relevance of the data:

1. *Completeness*: the dataset is a sample of the actual set of data. It includes 120,000 orders from the third quarter of 2015 to the third quarter of 2017. We believe that the datasets should provide sufficient information to depict Marriott demand behavior.
2. *Consistency*: Datasets are structured data, all in CSV format.
3. *Accuracy*: Datasets were provided by a trusted journal in the data science community. We can therefore assume its accuracy.
4. *Validity*: Datasets have already undergone through data cleansing processes (by the institution of telecommunication in Portugal). However, it could still contain misleading information as per updates in the booking records that are not transferred to the source system.
5. *Timeliness*: We have access to every single transaction that occurred in 2016 for a specific set of hotels therefore the database illustrates precisely one full year of operations.

Data Drawbacks

Although our team of analysts did the best they could to find a database that can be compared to Marriott International, it is obvious that each hotel chain has its own differentiation factor that can alter demand at a given time. Plus, even if the data is extensive, it is unclear if any records were accounted for during a time of special situation or exception. We are considering every record uniform and exposed to the same external factors. The data analyzed dates back to 2016, a more recent dataset could have represented today’s reality more precisely, however we are still confident that the seasonal trend remains instructive.

Results and Recommendations

Customer segmentation

Market Segmentation

First we analyzed the market segmentation of the hotel industry. Clients booked their room through five different aliases namely Corporate, Direct, Groups, Offline travel agent and online travel agent. From the graph in appendix 1, we understand that most of the bookings are through online travel agents. The number of reservations through online travel agents in 2016 represented 47.70% of all bookings whereas the next most popular intermediary was offline travel agents with 20.45% of booking. It would be imperative to focus marketing budget through this platform especially as competition is simply a click away. Moreover, from appendix 2, we see a spike in online travel agent and Direct sales in August whereas Group demand and offline

travel agent demand diminishes. It would be profitable for the company to shift marketing expenses from the latter groups to the former during this month.

Meal demand per month

Now in terms of meal demand, bookings fluctuate a lot across months. It would be interesting to capitalize on this as cost reducing strategy can be developed. For example, looking at Appendix 3, demand for bed and breakfast peaks in January and the next month's demand considerably reduces. As hotel chains usually order their food months in advance, Marriott international can take into account this nonuniform demand and order the right amount to reduce waste. Moreover demand for breakfast is relatively higher in May than demand for full board and half board, therefore reducing the supply of non-breakfast ingredients during that month would be optimal.

Reservation lead time

From Appendix 4, hotels rooms are mostly reserved within 0 to 25 days prior to check in. As the number of days before check-in increases, the number of reservations decreases. It is definitely in the company's interest to push customers to reserve their rooms earlier for multiple reasons, one being that the reservation booking date is actually one of the main drivers of booking cancellation as it will be described in the third section of the results. But more importantly, hotels want to secure the booking of their hotel the earliest possible to achieve full occupancy. It would definitely be in Marriott's best interest to offer incentives to customers when booking in advance.

Top Agent

Again, this dataset does not provide exact information about Marriott operation but the big picture does. So, looking at Appendix 6, it is obvious that some travel agents generate considerably more revenue to the hotel than others. In fact, "agent 9" in this case, generated 48.12% of agent sales out of the 535 agents contributing to this hotel sourcing. It is clear that those agents are of utmost importance to the occupancy of a hotel and they should be awarded consequently. Although it is important to diversify the source of revenue of the hotel, a recommendation available would be to reduce the number of agent relations that the company currently has and instead focus on the ones that generate the most traffic.

Demand Seasonality

Number of reservation

First we analyze the distribution of booking across quarters in appendix 6. The second quarter is the most popular followed by the fourth quarter, first quarter and third quarter respectively. Doing a deep dive into each quarter we can consult appendix 7 where the division

across months is represented. The second quarter composed of the month April, May and June have approximately the same high level of bookings. During the fourth quarter however we see that the month of November actually drives the quarter's number of bookings. Companies can increase their rate during this month or simply attract more customers by focusing their marketing budget.. In quarter three we see a clear anomaly in the month of August. When compared to other years in the dataset, the discrepancy persists, thus it is not a random event. The month of August is therefore not the ideal timing to push advertising campaigns as the demand is clearly well below other months.

Revenue

Now, comparing the demand per quarter with the revenue per quarter illustrated in Appendix 8, we can conclude interesting findings. First, revenue and demand have the same magnitude and pattern across quarters. This is a sign of uniform demand across product type. It would be interesting to study the different rooms available at Marriott International and how we could utilize each of them moving forward if provided the data. As shown Appendix 11 the daily rate distribution has a median 112\$, an upper hinge of 126\$ and a lower hinge of 99\$. From the same graph we notice more outliers above the 75th percentiles than below the 25th highlighting ways to capitalize on peak demand. The appendix 10 illustrates the rates across months and as expected higher rates coincide with higher demand.

Popular destination

Finally we analyze the demand across the different countries and identify the most popular destinations. From the packed bubble chart in Appendix 12, where only the most popular destinations are labeled we identify the UK as the country with the most booking followed by France, Spain and Germany. However it is important to note that this might be the result of a selection bias when constructing the dataset. Nevertheless, these destinations are definitely top vacations destinations and must be prioritized when developing marketing campaigns.

Cancellation Predictions

Cancellation across quarters

To tackle the issue of cancellation we must visualize the problem first. The appendix 13, shows that 26% of all bookings are cancelled. This can restrain revenue considerably as described in the introduction to this paper.

Cancellation across month

More precisely, the month of November has the most cancellations whereas the month of February has the fewest as Appendix 14 illustrates.

Cancellation per country

Drilling further into this issue we identified in the map of Appendix 15, the countries with the higher number of cancellation. The UK, Spain and France were by far the countries with the most cancellations but they were also by far the countries with the most booking. Therefore, Appendix 16 shows each country's cancellation rate defined by the number of cancellations divided by the total number of bookings in that country during 2016. We included only the countries that contain over 20 bookings during the year to have a reliable estimate. The result showed that countries with the most cancellations actually have the lowest proportion of cancellation and that countries like the United Arab Emirates had the highest cancellations rate of 83%. It would be in the company's best interest to analyze the booking conditions in those countries with higher cancellation rates and adjust them to the countries with lower cancellation rates.

Multiple regression

Finally, using PowerBi multiple regression tool, we were able to analyze a model that identifies the variable contributing the most to a hotel cancellation. The model's output in Appendix 17 shows that the deposit type required during the booking has the largest impact on cancellations with a coefficient of 0.71. More precisely, when there is *no deposit required*, the event of a cancellation getting cancelled increases 71%. Looking at Appendix 18, we notice the distribution of this database deposit requirements and "no deposit required" is the most frequent one. Marriott should try to limit this option as much as possible to avoid cancellations. To do so, they could implement a very low deposit requirement just to get the user more attached to its reservation. Now, the next most important influencer according to the model was the average daily rate of a room with an 0.46 coefficient followed by the fact that a customer cancelled his previous booking with the hotel chain or not. Other key influencers were drawn from this analysis and presented in the appendix 17.

Limitations and Moving Forward

Moving forward, it would be great to push the analysis on an updated database representing exclusively Marriott International reservations for more tailored recommendations. On another note, it would be very interesting to push the predictive model further and include cutting edge prediction tools like gradient boosting for example. Moreover text analysis on the latest review of a hotel available would be key input to the prediction model and the improvement of the Marriott's operations. The development of other unstructured data of the hotel industry will definitely help the analysis moving forward. Finally, we can also prioritize each advertising campaign and consider the budget available to optimize Marriott advertising campaigns.

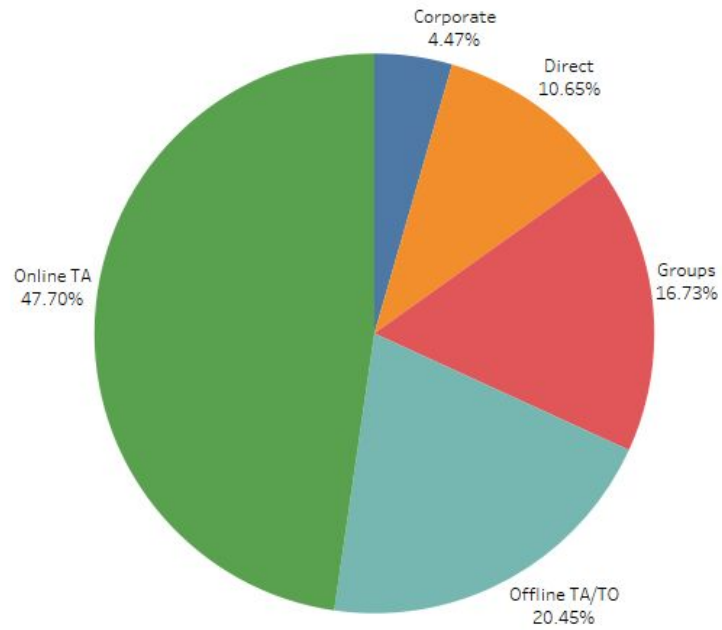
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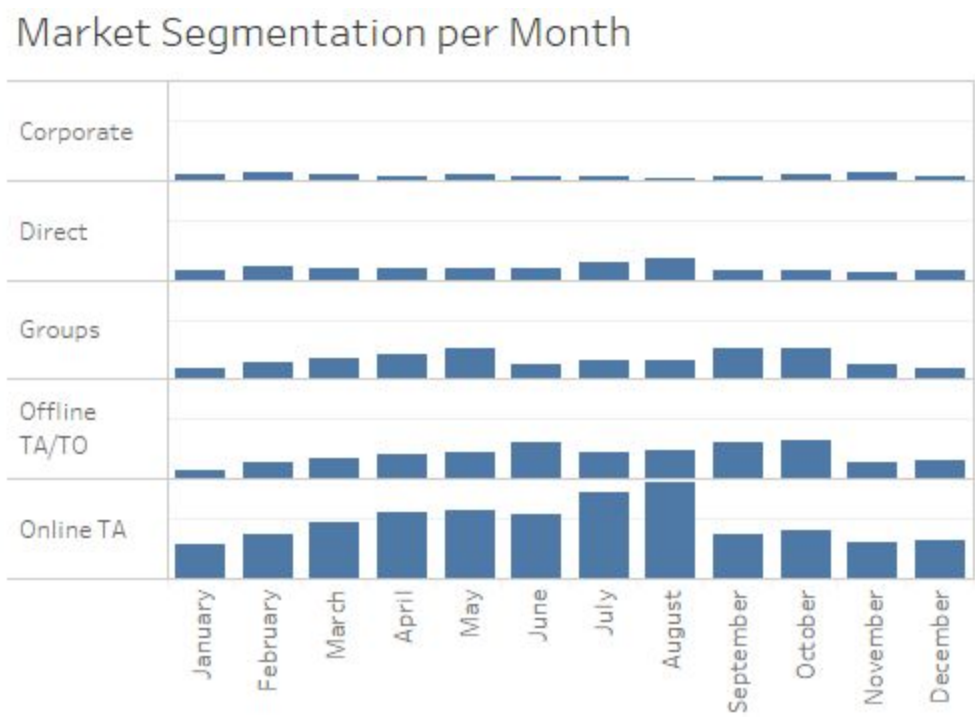
Appendices

Appendix 1

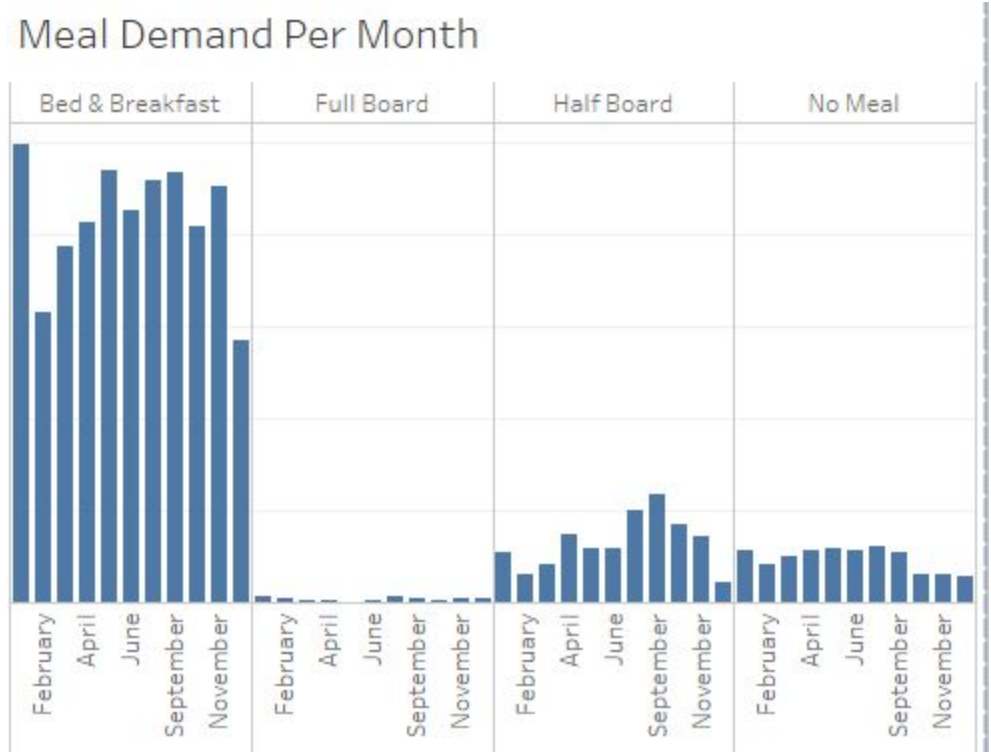
Market segmentation



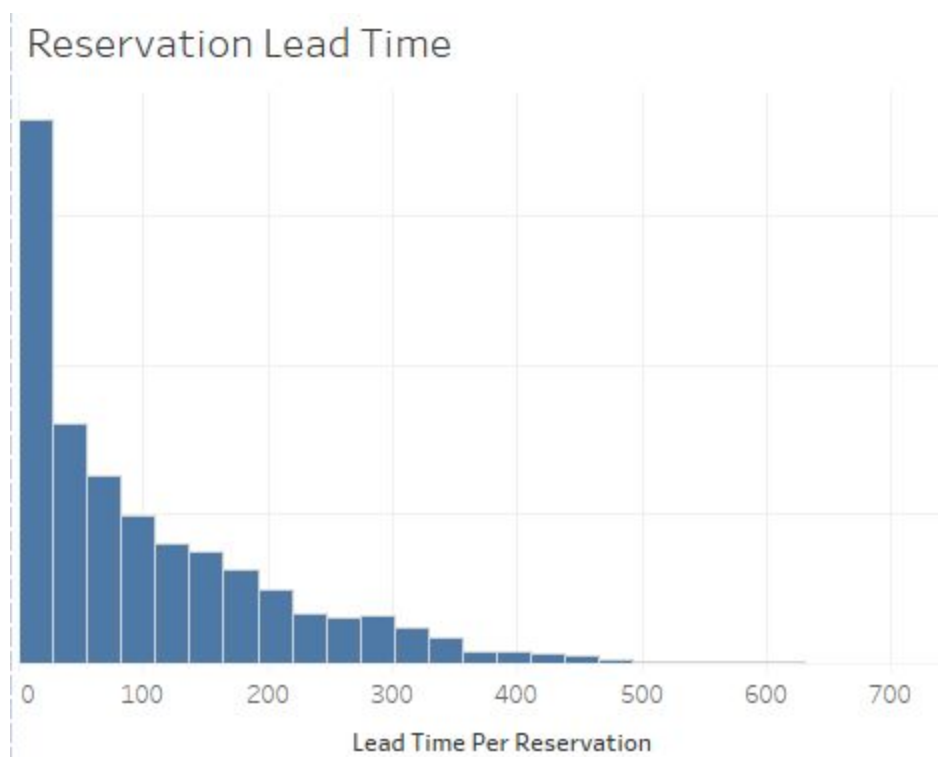
Appendix 2



Appendix 3

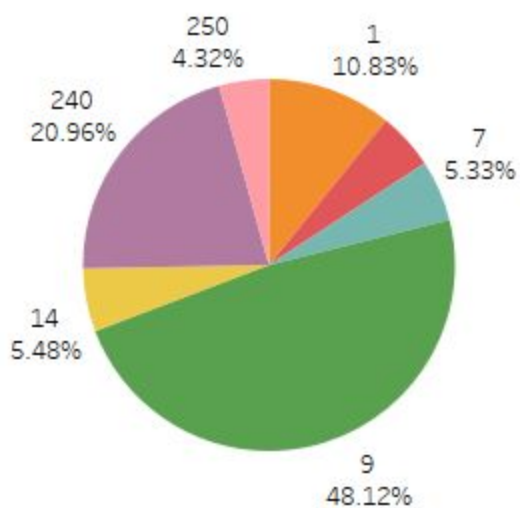


Appendix 4



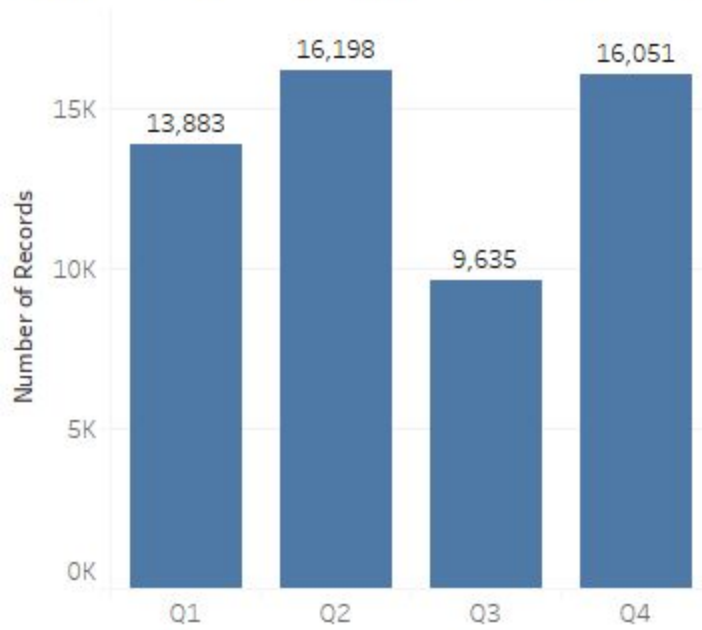
Appendix 5

Top Agent

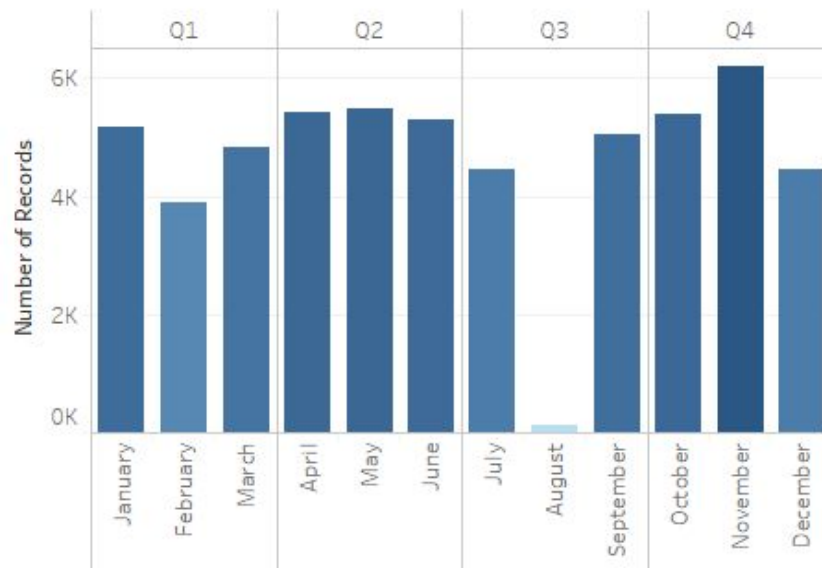


Appendix 6

Number Of Reservations Per Quarter

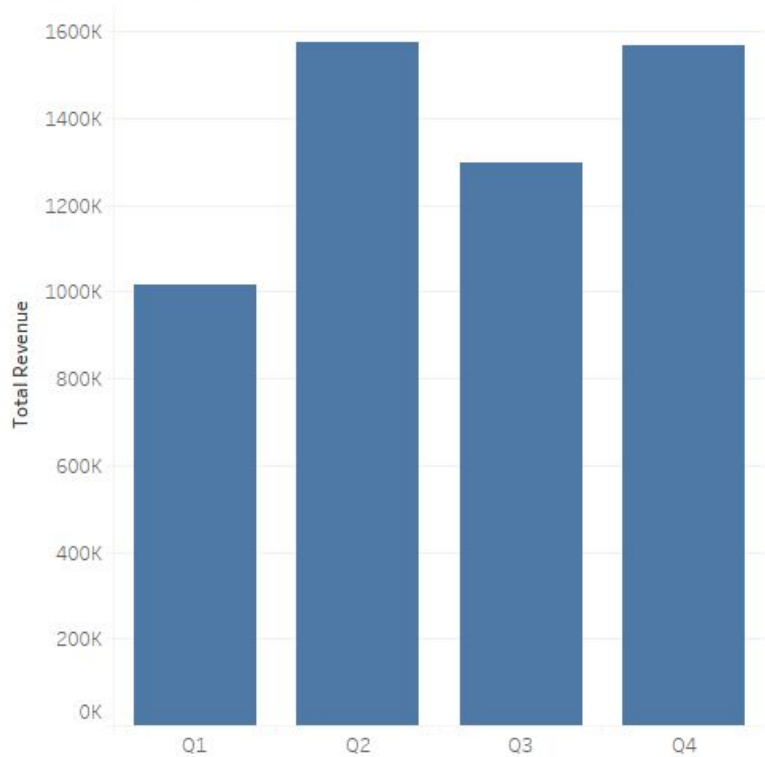
Appendix 7

Number Of Reservations Per Month



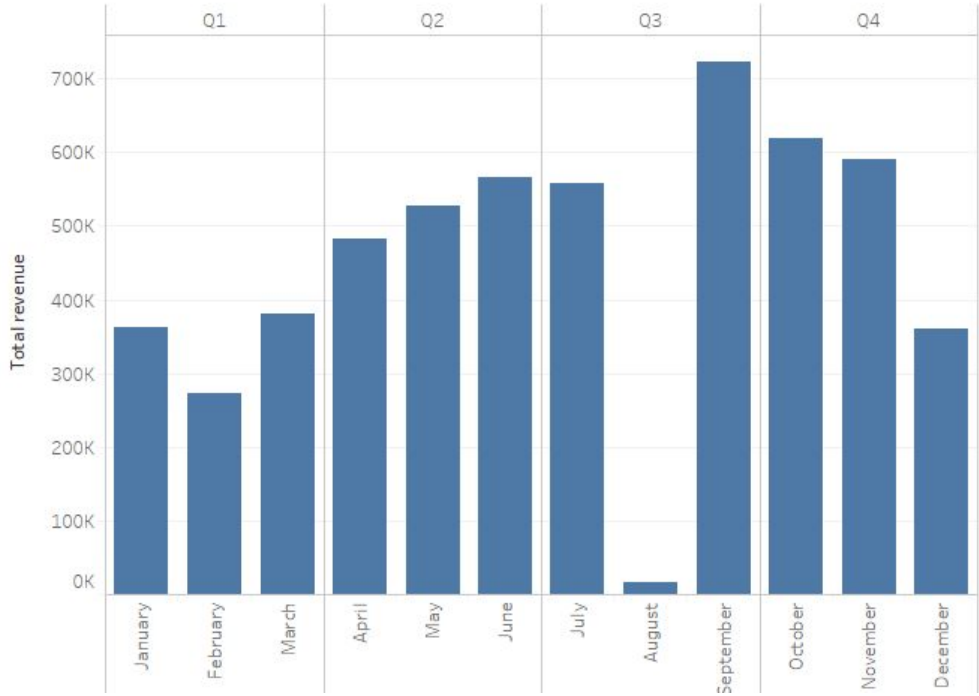
Appendix 8

Revenue by Quarter

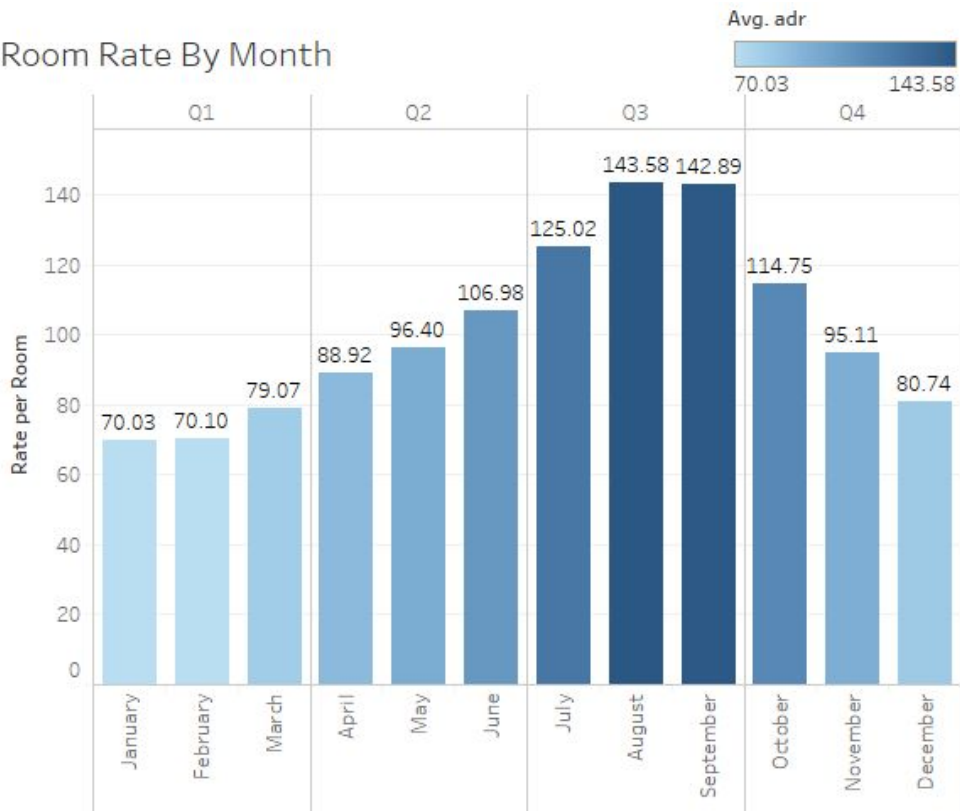


Appendix 9

Revenue by Month

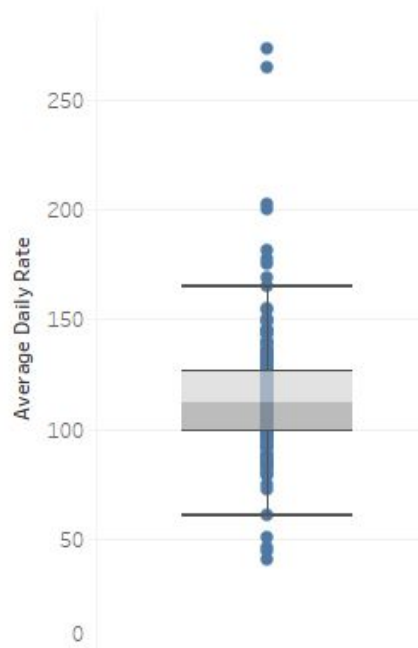


Appendix 10



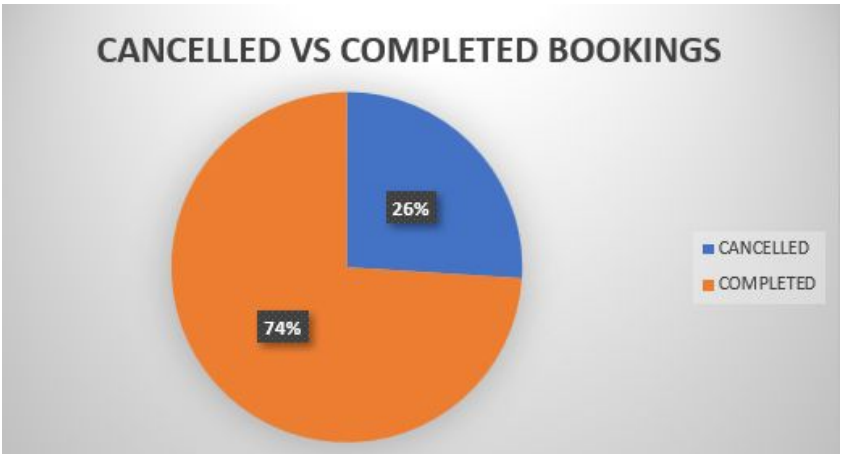
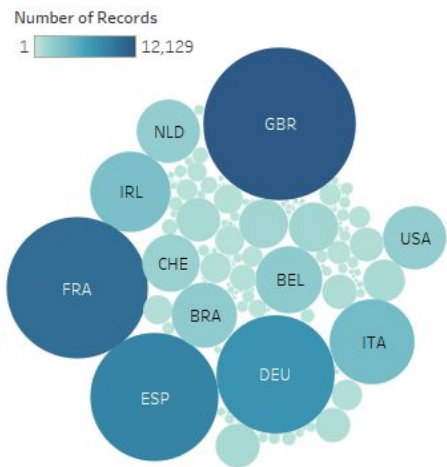
Appendix 11

Average Daily Rate



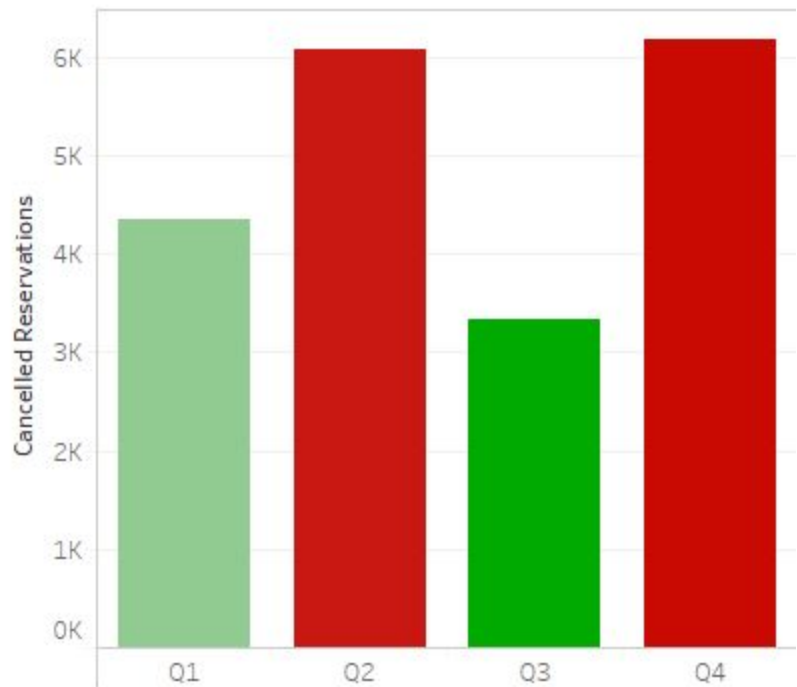
Appendix 12

Popular Destinations



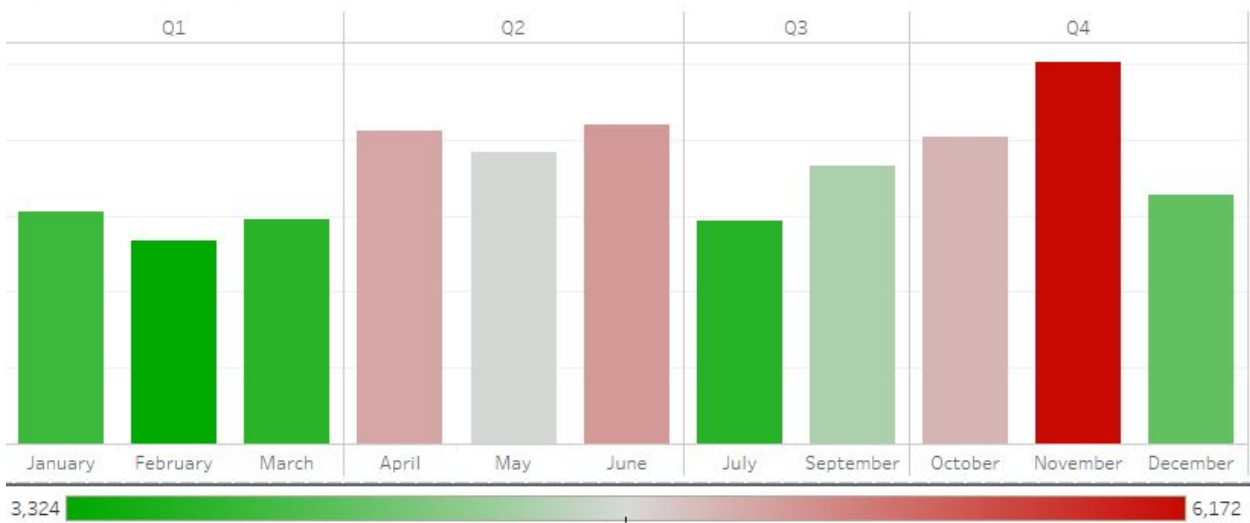
Appendix 13

Cancellation Across Quarters



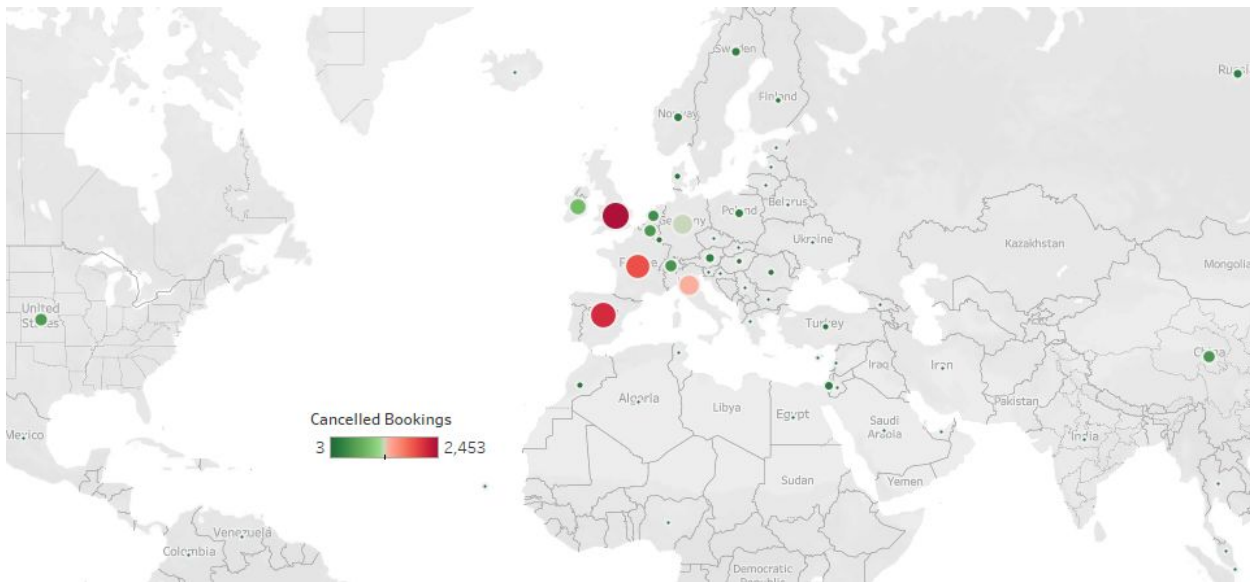
Appendix 14

Cancellation Across Months



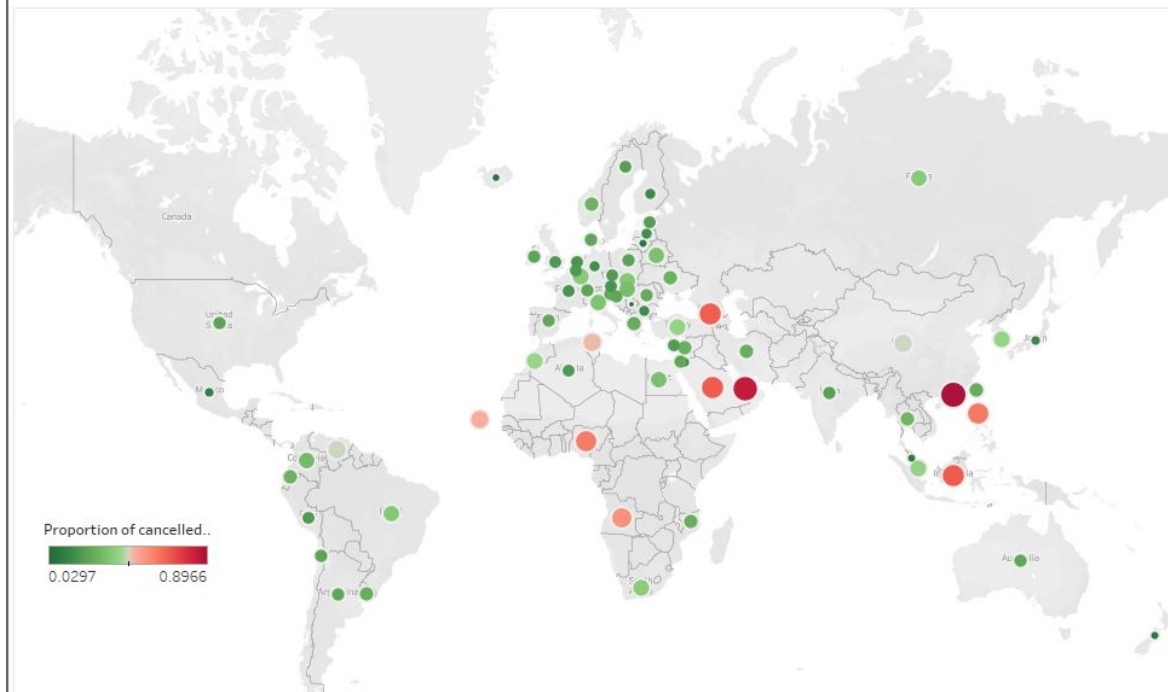
Appendix 15

Total Cancellation per Country



Appendix 16

Cancellation Rate per Country

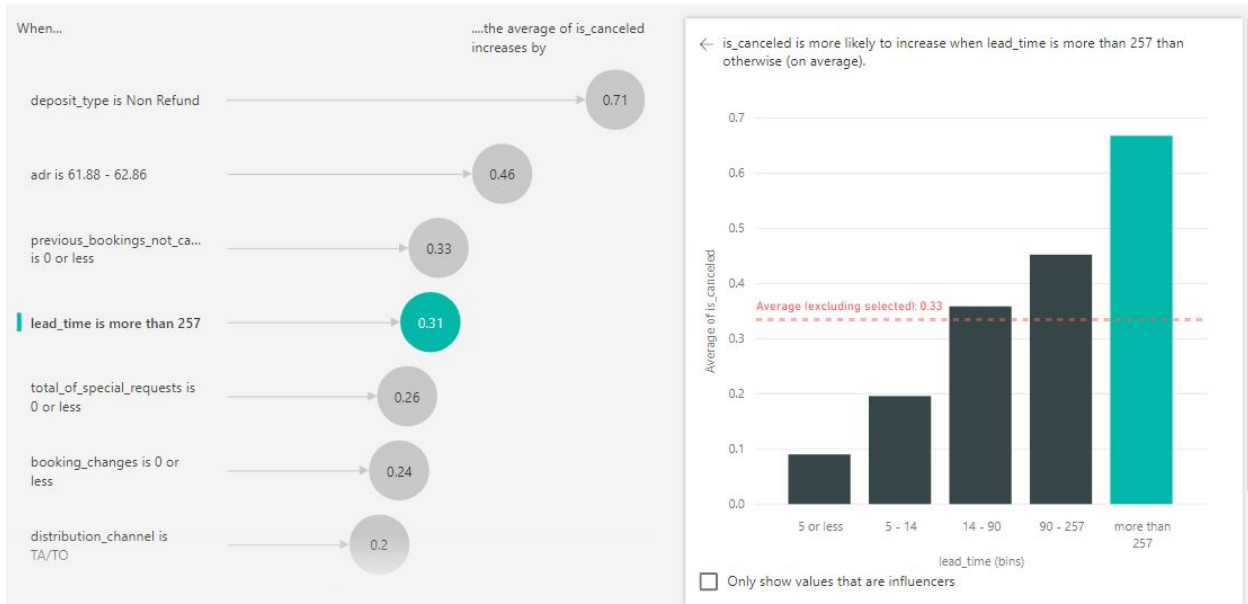


Appendix 17

Key influencers Top segments



What influences is_cancelled to ?



Appendix 18

