

## **Booking recommendations of search engines – Danger for the airline industry?**

**Sabrina Nachbaur**  
Wattbachstrasse 8  
9012 St. Gallen  
Switzerland  
+41 79 824 89 67  
sabrinanachbaur@hotmail.com

**Andreas Wittmer**  
Center for Aviation Competence (CFAC-HSG)  
University of St. Gallen  
Dufourstrasse 40a  
CH-9000 St. Gallen  
Switzerland  
+41 - 71 224 25 25  
andreas.wittmer@unisg.ch

This paper investigates the influence of search engines on the booking behavior of passengers and the airline industry. It is examined whether new functions of booking portals advising to book or to wait with respect to price changes in the future influence the booking behavior of passengers and whether the recommendations of search engines are precise. This is relevant and can become a threat to airlines with respect to ticket pricing. Therefore, an online survey was developed to collect data about booking behavior. 543 persons representing current and future users of online booking portals across all age groups in Switzerland and the surrounding boarder regions in Austria and Germany were used as a sample. In addition to the survey, an experiment to test the accuracy of booking portals was carried out. The results indicate that the booking recommendations of Kayak or Swoodoo are used by about 25% of all participants. In future usage can be estimated increase. Relations can be seen with the price sensitivity and the frequency of traveling. However, with different functions entirely different correlations were found. Overall, the survey shows that the features of the search engines can have an influence on the booking behavior of passengers. According to the experiment the portals must be assessed differently: while Google Flights was correct in all predictions, there were partial deviations for Kayak. Assuming that the portals continue to evolve and that passengers pay attention to these recommendations full service carriers need to be aware of these developments in the future.

**Keywords:**

Airlines, search engines, OTAs, revenue management, booking behavior, customer decision-process, strategic customers

# 1. Introduction

Nowadays, it is difficult to imagine booking a flight without the internet. Especially in the travel industry, the internet is the trigger for the major changes in recent years. Many people use the web to collect information about destinations, flights or airlines, but also to compare prices. According to a study of Allianz Global Insurance (2016), nowadays most people use the internet for booking journeys'. The largest part of bookings are made through search engines.

Online booking systems have developed over the years and meanwhile search engines offer new features, such as booking recommendations concerning whether to wait with the booking or a prediction of the future price development over the next few days is displayed (KAYAK, 2017).

Nowadays, airlines are in a highly competitive market, with margins of 5 - 10 % (NZZ, 2017). Price sensitive customers can have an impact on the revenue and profits of airlines (Anderson & Wilson, 2003). Price differentiation of airlines plays a significant role in terms of maximizing profit. Especially forecasting demand is key to make accurate prices (Belobaba, Odoni, & Bernhart, 2016).

The following questions help understand the impact of new online booking engines with price forecasting functions:

- What effects do booking recommendations of search engines have on the revenue of airlines?
  - To what extent do the booking recommendations of search engines influence the booking behavior of passengers?
  - Are the recommendations of the different portals reliable and precise?

Due to the increasing importance of booking portals and their recent development, in a first step the influence of the features on the booking behavior of passengers is examined. In a second step, the precision of recommendation given by booking portals is examined.

## 2. Literature

### 2.1 Online travel agencies and meta-search engines

Nowadays, hundreds of different online travel agencies (OTAs) are available and consumers lose track easily. However, not only OTAs but also meta-search engines exist. OTAs are websites that offer a platform for customers to book a flight, whereas meta-search engines do not sell anything; rather, they scan different tourism providers, travel websites, OTAs and reservation systems and compare offers and prices. Famous meta-search engines today include Kayak, Skyscanner, SeatGuru, Google Flights or Momondo (GP software.travel, n. d.).

Search engines have developed rapidly in recent years and regularly developed new functions. In October 2016, Google announced that their own flight search engine – Google Flights – will have new features. One of the most important function includes a notification of likely airfare changes in the future. So far, Google Flights only have showed the consumer a chart of the prices and a calendar of fares and inform users when the prices increased or declined. However, a recent new service includes a notification at which time the airfare, will expire. The customer will know how much they will lose if the booking is not made within the next hours. This function is not 100 % accurate, but Google has a lot of historical data of different airlines and flights and can improve forecasts (CONDE NAST Traveler, 2016). A study of IATA (2016) mentioned that Google will play an even greater role with respect to airline revenues in the future. However, it remains unclear whether they also want to become an OTA. Though, not only Google Flights offers such booking recommendations; indeed, other websites such as Momondo, Kayak, Skyscanner or Swoodoo also do so. For example, Momondo provides an overview with the most essential information for a booking. Information such as the cheapest airline or the best days to book is shown (Handelsblatt, n. d.). In addition, Kayak has a function that is unique: when searching for a flight, Kayak shows a price prediction for the next seven days. It gives a recommendation whether to book immediately or wait (KAYAK, 2017). When using the comparison portals and booking a flight, a field shows that the prices are likely to decrease in the next few days or that the displayed fare is the best for the next seven days. However, some travelers wait for this duration and they are disappointed when they recognize that the fare no longer exists or is much more expensive.

### 2.2 Booking and travel behavior of the Swiss population

The booking and travel behavior has changed enormously over recent years. In 2005, 17% of bookings in Switzerland were made through the internet. According to Allianz Global Insurance (2016), 67% of people use the internet to book a journey. While bookings through the web page of the supplier itself increased by 8% from 2014 to 2016, bookings through OTAs or travel search engines have stagnated during the last three years. However, it still has the highest share of bookings, with 66% (Allianz Global Assistance, 2016).

A study of IATA (2016), examining the future of airline ticket distribution of airline tickets, presents that by 2021 OTAs will still have a high share, although it will sharply decrease by about 20%. In contrast, reservations through an airline's own channel will increase from 33% in 2016 to 45% in 2021. However, it can not be ruled out that the search via an OTA will take place, but the booking is processed finally on the airline's own website.

Allianz Global Insurance (2016) also found that tourists make their reservation for holidays later. 46% of the population book their trips normally more than two months before departure. However, this number shows a decrease of 4% compared to the previous years. The youngest and oldest age groups in this study tend to book less than two months before.

The most decisive factors for customers in selecting a flight are price, image and safety (Wittmer 2006, Elvia 2009, IATA, 2016). It is shown that the price is by far the most important criterion when deciding for a flight and has further increased over the last few years. 42% of all travelers worldwide would even

change their destination to adjust it to their budget (IATA 2016). This behavior can mostly be seen among travelers aged 25 to 49 years (IATA 2016). A higher share of 56% mentioned that they would choose another airline to remain within their set budget. Therefore, price sensitivity in the airline industry is high. The importance of the price rose from 2002 to 2011 from 24% up to 45% (Conrady, Fichert, & Sterzenbach, 2013). The importance of the price is not only high for leisure travelers; indeed, it has also changed over recent years for business travelers. More than three out of four business travelers mentioned that the cost pressure is higher than previously.

When describing the decision process of passengers and the factors that influence the decision, one needs to look into the types of different customers. In the booking process, customers can be divided into strategic and non-strategic customers. Strategic customers are those who think that waiting will result in a cheaper flight ticket, whereas non-strategic – also known as myopic – customers are those people who purchase at the time of arrival and not wait to get a lower airfare. Their decision is mainly based on the comparison between the willingness to pay and the actual price (Christ, 2011).

In many studies, it is assumed that customers all behave the same way: they buy the product immediately or leave it forever. Meanwhile, newer studies – non-aviation or aviation related – also include strategic customers and the assumption that customers behave differently. These studies include the extent to which strategic customers are present or how strategic buying behavior influences the revenue of different companies. However, measuring the real degree of strategic customers is complex. Therefore, such studies are based on many different assumptions, as a result various outcomes are available (Li, Granados, & Netessine, 2014).

Dynamic pricing and revenue management help airlines to be successful in increasing their profit. Just a small amount of additional revenue can have a great influence on the airline's profit. Anderson & Wilson (2003) have investigated the impact of strategic buying behavior particularly in the airline industry. Depending on the demand and the share of passengers who are willing to wait, the loss can be between 1% and 6%. This shows that strategic customers can lead to a serious problem for airlines.

Li et al., (2014) conducted a first research in the US market to ascertain the number of strategic customers in the airline industry. They argue that between 5.2% and 19.2% under rational expectations of the customers are strategic depending on the market. This amount can vary according to the scenario that they have analyzed. Customer perfectly know either the prices, rational expectations or a weak forecast. In different markets, the number of strategic customers can vary. For example, for short-haul flights, there are more strategic customers. The authors assumed as a reason the fact that there are more alternatives. Moreover, for flights with higher prices, the tendency is that more customers are strategic, as the possible savings are higher. Finally, in markets with a higher price volatility the share of strategic customers is higher, as the possibility of savings is also higher. The authors also found that strategic customers mostly appear either at the beginning of the booking period or close to departure, whereby at the beginning means about two months before departure. As a reason, the lower risk that the flight is sold out can be named. Shortly before departure is defined as mostly about three weeks before. In addition, the authors argue that strategic customers do not always have a negative impact on revenue. As a reaction to the results, they investigated how airlines should react regarding pricing. If they used non-decreasing pricing, this would end in higher yield for business travelers, but a small decrease in the leisure market. An explanation can be found in the effect of price-reduction and the demand. With the behavior, strategic customers can lead to price decreases. Therefore, even business customers will pay a lower price. Strategic customers have an impact on the volume of the flight, as low prices increase the demand. Therefore, when using non-decreasing prices, they avoid strategic customers but reduce the demand. However, in this paper the competition situation was not included (Li et al., 2014).

Yin, Pazgal, & Tang (2009) went a step further and investigated inventory systems in the presence of strategic customers. On the one hand, when a customer can see the remaining capacity and on the other hand with one display only showing the availability of the searched product but not the number of remaining other products. This system can often be found in tourism, especially with OTAs as they use

sentences like “only two seats remaining”. They found that with strategic customers one display could reduce the influence of revenue for companies, as a reason that with the perfect foreseen availability it is easier to delay the purchase.

Finally, Cleophas & Bartke (2011) examined the effect of experience and communication on the number of strategic customers. When customers have been faced with an unsuccessful result, this experience will reduce their optimism for the next purchase. In certain cases, this can lead to fewer customers being strategic in the second period, thus resulting in increased revenue. However, overall learning does not have a strong influence on the future revenue. The effect of communication is dependent on the capacity, which is sold for a lower price. If this only accounts for a small amount, most of the strategic customers will be unsuccessful and thus it will lead to a decrease. However, when more than 40% of the capacity is sold at a lower price, most of the strategic customers are successful and thus with the communication the share of strategic customers increases.

## **2.3 Pricing and Revenue Management**

Today, the pricing of an airline is a complex system as the airline demand is determined by various factors such as high fluctuations, unknown information about the travelers’ intentions such as their departure date or destination, as well as the number of cancellations. By contrast, airline supply is determined by aircraft capacity and is a perishable product (Cento, 2009).

The price elasticity is an important criterion when determining the price. Revenue management (RM) is closely connected with price elasticity. Revenue is mostly managed by setting prices (Belobaba et al., 2016). It is defined as “the subsequent process of determining how many seats to make available at each fare level” (Belobaba et al., 2016, p.73). RM includes a lot of different aspects such as steering demand over time, overbooking, formation of booking classes and forecasting and inventory control.

In the airline business, it is known that the high-price demand tends to occur later than the demand for lower prices. An uncontrolled distribution of demand would have the effect that passengers who prefer lower prices take all seats those who would pay a higher price would not get a seat. This would result in an unsatisfactory revenue for the airlines. However, to obtain the highest possible revenue, the demand of the passengers with a higher willingness to pay needs to be satisfied in a first step. The remaining seats are then made available for the other passengers (Conrady et al., 2013).

## **3. Research Approach**

### **3.1 Online Survey about booking and travel behavior**

To gain new data about booking and travel behavior of passengers combined with the usage of the features of search engines an online questionnaire was developed. Different filter questions have been used to reach out to different traveler segments such as the leisure or business traveler.

Since the aim of this paper is to ascertain the effects of the new features of the search engines of the booking behavior of the passengers, the audience should include ages groups and different purposes of travel to divide them in the analysis in the various segments. This means that the population relevant for the survey includes all people who already booked or searched – or will most likely do so in the future – through a booking portal and live in Switzerland and the border regions in Germany and Austria.

However, when using the non-probability method, as in this paper, it is likely that participants are not representative. Nevertheless, this sampling can still be used for research (Jacob, Heinz, & Décieux, 2013).

For the survey, the quota sampling and the snowball sampling were used. As previously mentioned, persons with different travel and booking behavior must be part of the sample. Indicators for the variation are the age, the frequency of traveling as well as the professional position. Therefore, several

distribution channels were used to reach all the different travelers. However, participants were also chosen, as they were easily reachable.

### 3.2 Experiment booking portals

The second research approach included an experiment to evaluate the accuracy of the various booking portals. 12 different destinations were used as a sample. Those are chosen from the route network of Swiss International Airlines as they provided the daily prices to assess it. Prerequisite was that the flight is a non-stop flight with a minimum number of stops. Destinations were divided into subgroups. Typical holiday destinations along with business destinations as well as short- and long-haul flights have been used. The departure date was intended to be within two months to have a longer period of observation. However, for business destinations such as Frankfurt or Paris, a shorter period of two weeks before departure was also observed since these usually book relatively short term. For the analysis to be meaningful, multiple search queries are tested. All of the departure times were also selected randomly. Chosen Destinations were:

- Amsterdam, Paris Charles-de-Gaulle, Frankfurt, Heraklion, Las Palmas, Tampa, Nairobi, New York John F. Kennedy, Punta Cana, Havana, Montreal

The flights were searched in three portals: Momondo, Kayak and Google Flights. The recommendations of the portals were checked twice weekly, with starting date March 16, 2017. However, in order to not only have data for the same days, data gathering was conducted irregularly: mostly on Sundays and Wednesdays, but certain inquiries were also made on the following days.

## 4. Analysis and Results

### 4.1 Online Survey

First, descriptive statistics was used to describe the results. Second, explorative statistics describe the relationships between different variables with cross-tabulations. Third, associations were checked with chi-square-tests. By this possible relationships were confirmed.

All of the proposed age groups are represented. However, there are wide differences in the distribution. Especially the younger age groups until 35 years are strongly represented with a total percentage of 78.3%. This reflects a total of 425 persons. The age group 36-45 years has a total of 47 persons (8.7%), while 46-55 had nearly the same amount, with 46 persons (8.5%). Between the ages of 56-65, 20 people (3.7%) participated. Finally, only five persons (0.9%) over the age of 65 were part of the survey.

The highest share of the participants are generation Y people often being students (234, 43.1%), followed by 191 skilled labor (35.2%). Of all the interviewees, 10 (1.8%) are not studying or working, 15 respondents (2.8%) are apprentices, 60 persons (11.0%) work as department managers/team leaders, 7 (1.3%) as managers or chairpersons whereas 26 persons (4.8%) are self-employed.

481 persons (88.6%) travel up to five times a year. 34 persons (8.5%) travel between 10 to 20 times a year. 16 persons (3.0%) mentioned that they travel more than 10 times a year. The highest number for annual travels could be found with two times a year (27.8%). The minimum was zero, while the maximum was 40. The mean is 3.64. To have a detailed picture about the distribution of persons who do not travel often and the frequent flyers, the data was combined to a statistic comprises infrequent, medium and frequent travelers. Infrequent includes the amount between one and five times a year, while medium contain all travelers between 6 and 10, and above 10 they are included in the frequent travelers.

Of all the participants, 196 (36.1%) travel for professional purposes. The range of number of annual travels is from 1 to 60. However, most of the business travelers fly once or twice a year. For this question, the answers were concluded to infrequent, medium and frequent flyers.

Persons mentioned that if they book European flights, they tend to book later than for intercontinental flights. In addition, if they have a tendency to stay for a longer time, they book earlier. Most of the people (84.2%) book their flights more than one month in advance. They highest share (34.6%) tend to book 2-3 months before departure.

Participants were asked to mark all booking portals that they normally use when they book a flight. Skyscanner is by far the most commonly-used search engine, followed by Expedia and Swoodoo. 227 persons out of all participants use Skyscanner. Overall, an average of two portals are used.

Finally, the participants were asked how important the price is overall when booking a private flight. While 1 means not important at all reflects 5, being the most important criteria, the mean was 4.19. For most of the people (84.8%), the price is either the most important criteria (5) or one of the most important criteria (4). Only five people out of 542 (0.9%) chose that the price is the least important factor (1).

In the second part of the survey, questions about the usage of the different booking portals and their feature were asked.

58.3% of the participants have already used the function of the flexible booking date. This reflects a total of 316 persons, while 225 participants (41.7%) have not used it for private flights.

Out of all 542 private travelers, 80 (14.7%) know the function of Google Flights. The rest of 462 persons (85.2%) have no knowledge about this function. Out of the 80 persons who know the function of Google Flights, 47 (58.8%) have not used it yet, whereas 33 (41.3%) have used the function. Of all the participants this reflects only a share of 6.1%.

With a screen shot of the Kayak recommendation, the participants were asked if they know the function of the booking recommendation. 146 persons (26.9%) answered the question with yes, while 397 participants (73.1%) do not know this feature. Out of the 146 persons who know the function, 78 persons (53.4%) have tried it. However, 68 persons – the highest share with 46.6% - have never used the feature. 45 persons (30.8%) have used it between two and five times. While 21 participants (14.4%) have used it only once. In total, 12 interviewees (8.2%) have used it more than five times, while six people (4.1%) each have used it either between 5 and 10 times or more than 10 times.

Out of the 78 who have used the function once or more 22 persons (28.2%) have waited 1-2 weeks. The share of the persons who waited less than 1 week, 2-3 weeks or 3-4 weeks is nearly the same, with 15, 17 and 18 persons. Only six persons (7.7%) have waited more than one month.

Only for five persons (6.4%) the flight became more expensive than at the beginning of the waiting period. 21 persons (26.9%) – reflecting the highest share – saved CHF 50-100. 19 persons (24.4%) were able to save CHF 100-200 with the recommendation to wait. In total, 27 persons (34.7%) saved more than CHF 100. Out of these 78 persons, only one person would not use the function again under any circumstance. 10 interviewees (12.8%) answered as less likely while the rest 67 persons (85.9%) will use the function again.

Eleven persons who mentioned that they would use the function again in the future less likely or under no circumstance were asked for the reason. Six participants mentioned that they would like to book the flight immediately. Two persons stated that the last recommendation was wrong and as a result they would not use it again, while for two interviewees it is not clear how the function works. One person declared that this function increases the number of daily mails and therefore would not take advantage of it again.

68 persons know the recommendation but have not used it. Therefore, they were asked for the reason. It shows almost the same picture as with the persons who would not respond to the recommendation. Most of them (26, 32.8%) would like to book the flight immediately or doubt the trustworthiness of the portals. 22 persons mentioned that they did not know how the function works. One person gave an individual answer that this person has the possibility to book through staff portals.

The 396 participants who have not used the function yet were asked hypothetically about the future usage. 313 persons – which reflects a share of 79.1% – would be willing to wait when they have seen the recommendation. 83 participants (20.9%) would not respond to the recommendation. Most of the 313 persons (47.5%) mentioned they would wait for 1-2 weeks. Less than two weeks already accounts for 73.0% of the total participants. 15.3% are still willing to wait up to three weeks.

On the other hand, the participants which would not respond to the recommendation and still book the flight immediately, gave different reasons. 83 participants answered that they are unwilling to wait when they see the recommendation. The most commonly-mentioned reason was that they would like to book the flight immediately. Moreover, the trustworthiness of the portal was questioned. 30 persons (38.5%) do not trust the portal. Six persons (7.7%) mentioned that the price is not important. Five persons mentioned a different reason.

- If the price is correct at the time of booking, I won't wait
- As soon as it gets cheaper, everybody books the flight and maybe the flight will be fully booked (three persons)
- Time is more important

However, these can be connected with the sample answers. They book immediately as the risk that the flight could be fully booked.

Finally, statistical correlations were checked with the chi-square-test. The first one can be seen between the importance of price and the usage of price alerts ( $p=.000$ ). Mostly persons who mentioned price as most important (24.4%) make use of price updates. However, the correlation is weak ( $CC=.241$ ,  $p=.000$ ; Cramer's  $V=.248$ ,  $p=.000$ ). Still, it is the most significant correlation between a variable and the price alerts. In addition, combining these two variables is more likely underestimated, as it is a combination between nominal and ordinal variables. This correlation is comprehensive, as price alerts can help to find a cheaper price or inform about price increases or decreases. It also can help with a review of the price changes to predict the future price development.

Moreover, with Google Flights, a correlation to age groups can be excluded. A statistical association between the professional position and the knowledge about Google Flights is also not given. However, a certain relationship is disguisable. The highest share of persons who know the function, reflects managers, self-employed and skilled workers. Therefore, it could be assumed that possible those who also travel more often for business have more knowledge about it. 51 of business travelers also use Google Flights. Therefore, it could be possible that it is used for professional flights. However, this assumption cannot be proven as the survey does not include a question concerning which portal is used for professional and private reasons.

Furthermore, a statistical correlation can be perceived between the number of travels and the knowledge about the feature of Google Flights ( $p=.000$ ). The significant is also weak, but it should be assumed that in reality it is even higher ( $CC=.185$ ,  $p=.000$ ; Cramer's  $V=.189$ ,  $p=.000$ ). The more people travel, the higher the share of those who know about the functions of Google Flights. This correlation is also reflected with the users of Google Flights. The more often that they travel, the more persons use Google Flights as a way to book their flights.

Another correlation is visible between the date of booking and the knowledge about Google Flights. However, chi-square cannot be used as more than 20% cells have an expected count less than 5. Nonetheless, it is visible that the later that people book their flights, the more they know about the feature. The highest share can be found less than one week before departure, among which 50% of the participants know the functions. As a reason, it can be stated that Google Flights only gives recommendations one month or later before departure, as shown by the experiment. Moreover, as mentioned above, a relationship can also be seen with the business travelers. They tend to book later, as the survey shows, and therefore it could again be the case that many business travelers know Google Flights.

A statically association between the age groups and the knowledge about the recommendations is also excluded. However, a certain non-statistical relationship is observable. The age groups 18-25 and 26-35 years have the highest share of participants who know the function of the booking recommendations. The following age groups have a lesser share. These groups including 36-45 years are also those who have used the function the most times. In addition, a high share could be seen among the age group 56-65. However, the number of persons in this age group is only small. Therefore, this number can also be seen as a coincidence. On the other hand, this cannot be confirmed when looking at the age groups and the use of different portals. Most of them have nearly the same share in all age group, whereas only for Expedia is there a deviation. The older age groups mostly use it. Therefore, it cannot be argued that mostly young people use Kayak or Swoodoo as a reason. This relationship between the age and the usage cannot be checked statically because the sample is too small and many cells in the cross-tabulation contain no or few values. However, it is visible that especially people between 18 and 35 years have mostly used it.

A relationship ( $p=.005$ ) between the number of travels and the knowledge about booking recommendations is evident, but it is rather weak ( $CC=.139$ ; Cramer's  $V=.139$ ). It seems that persons who travel more than five times a year know the function better. However, the percentage depends on either looking at the total of persons knowing the function and the total of persons in each frequency class of traveling. Out of 145 participants who know the booking recommendation, 118 persons (81.4%) travel between one and five times a year, while 27 persons (18.6%) travel more than five times a year. However, out of the total travelers in the category infrequent, 24.6% are using the function. Medium has a share of 45.7% and frequent 37.5%. A reason for this cannot exactly be named. Nonetheless, comparing the frequency of travelers and the booking portals that they use, it is visible that Kayak – for example – has the lowest share among travelers who travel less than five times. However, Swoodoo shows the highest share for this category.

Between the price importance and the knowledge, there is absolutely no relationship recognizable. Of all levels of importance, the number of persons knowing the feature is almost the same. The percentage of all importance varies between 20% and 30%. However, a small difference is visible between the importance of one and five. The more important that the price is, the higher the share of persons who know the function. However, this function cannot only be reduced to price-sensitive persons.

An association between the time before booking and the number of uses can also not be observed. However, the highest share can be seen with people booking 1-2 weeks before. Only two persons would wait for more than one month. The waiting time goes down if they are traveling for a shorter period. However, the number of people who wait less than one week constantly grows as the travel duration decreases. As a reason for this development, it might relate to the amount that they need to spend. If they are traveling for a longer time, it could be the case that they are flying long-haul and those flights are mostly more expensive. Therefore, they are willing to wait for a longer time.

In addition, people knowing the booking recommendations also tend to know Google Flights and use price alerts. This fact can be seen that people using more than one function to find the cheapest flight ticket. This correlation is also confirmed by the chi-square-test ( $p=.000$ ).

Finally, the people traveling less than five times a year would mostly (79.6%) wait if Kayak recommends to do so. However, this statement is not as meaningful as the number of people traveling more declines. In addition, frequent travelers would wait for a shorter time, while people traveling less would wait for a longer period. However, a statical correlation is not given ( $p=.708$ ). Nevertheless, a certain relationship can be seen, whereby the price importance of 4 or 5 has the highest share of future users. The reasons for not using it is also connected with the price importance. They would like to book the trip immediately or the price is not important.

## 4.2 Experiment

After May 17, 2017, the results were compared with the historical recorded data of Swiss International Air Lines. For the analysis only, the booking class with the lowest fare was relevant.

### **Momondo**

As already mentioned, Momondo offers a flight insight for almost every flight. However, Momondo only shows combinations of flights from the same airlines or code-share flights. Combining bookings of airlines that do not have a code-share or are in the same alliance are not listed. For example, Swiss International Air Lines was not combined with Iberia. Momondo also provides a function that predicts the best day to book a flight. However, not only this information is given; moreover, it also offers a complete overview of the various factors that contribute to the price formation, with a pie chart showing the extent to which the price is influenced by these factors. An individual recommendation for flights at different departure times or days is not available. Moreover, it emerged that the overview can change over the time, whereby the changes are quite substantial. For example, Tampa on July 2, 2017 shows 59 days before departure as the date with the cheapest tariffs. However, at the beginning of the experiment it was 24 days before departure. This fact is likely to be linked to the number of analyzed flights included. This number also changed over time. However, it is not possible to establish another reason why these changes are so drastic.

As there were no ongoing recommendations on specific days available, in the experiment the recommended day before departure to book a flight was compared with the actual cheapest day over the period of 60 days. Certain flights had the cheapest price 62 days before departure. However, as Momondo only recommends for 60 days before, it was only compared within this period. As already mentioned, the recommendations changed over time. Therefore, the recommendation given on March 16, 2017, was considered in this experiment.

The experiment shows that no real connection can be recognized. A reliable feedback cannot be drawn due to the fact that the general information is valid for all airlines and all dates. Even with the same destination on the same day but at a different departure time, there are different days with the best tariff. For the most part, only a few days (10 days +/-) are between the predicted and the actual favorable rates. However, there are also major deviations. Especially with the European city destinations, there was only one larger difference of more than 10%, otherwise, the differences are mainly for long-haul flights such as Tampa, Punta Cana and Havana. Moreover, Heraklion and Las Palmas have the best rates available less than one month before departure. However, due to the small sample and the presence of only one flight on these routes, this cannot be regarded as an indicative value. When analyzed as a deviation of CHF 50, it can be said that 14 out of 21 are correct. There is a greater difference for the remaining seven. In addition, some flights were cheaper before the recommended date and some were later.

In addition, it was checked whether shown statistics of the price development were precise compared to the actual price development. Only with four destinations, a certain accordance can be found namely, Paris, Frankfurt, Las Palmas and Punta Cana. Overall, they are rather different.

### **Kayak**

Kayak offers a unique function of the booking recommendation. If a flight is searched, a chart shows the price development over the next seven days and indicates whether to wait with the booking or book immediately. Kayak suggests booking if the prices are not likely to fall more than CHF 20. However, over time this recommendation also changed. Now they left the amount of CHF 20 and just added the sentence that these are the best prices for the next seven days. They also removed the graphical prediction of the price, which was only available on the German website. The analysis emerges that in case of short-term changes, this means price increases and decreases on the following days were not predicted. However, if long-term price reductions resulted, this was mostly predicted correctly. Nonetheless, it must be added that the largest price decrease – which did not immediately increase to the previous level – was foreseen.

What needs to be considered is whether the passengers already book or wait for the first possible reduction. The same question emerges in the case of a price increase after two days, whether passengers would panic and book immediately or wait for further days is unclear. In this situation, it is also important how and whether the prices are checked over these seven days. It is often noted that two days later it is no longer recommended to wait, although prices have continued to fall within the seven days period. Ultimately, it can be stated that a certain amount can be saved. To have a quantitative number, the results were checked according to two scenarios and two different waiting times. The first scenario looked at the savings if the passengers book immediately after the first change and do not wait over the whole period. The second scenario assumes that the passengers actually wait and book the available rate after 7 or 14 days. 14 days is only applied if there was a second recommendation over the time.

In the case of European flights, there were two changes with 8% and 10%. For Amsterdam, it would be possible to save 10% when booking 49 days before departure and immediately after the first change. Amsterdam had another recommendation 10 days before, but it resulted in the same price as at the beginning. Heraklion offers the possibility to save 8% (CHF 25) when waiting for 14 days after the recommendation on day 59 before departure. However, if we look at the long-haul flights, some changes are also much greater. Havana and Nairobi had both a recommendation 49 days prior, but it ended with the same price as at the beginning of the observation duration. For the destination New York, the savings were between 19% and 30% depending on the scenario. Only one recommendation was given by Kayak 61 day prior to departure. In the subsequent tests, it was advised to book. Montreal, Punta Cana and Tampa show the most changes.

Assuming a passenger searches for a flight to Montreal 62 days before departure and waits one week, he can save CHF 173, which equals 20%. If the passenger is willing to wait for 14 days, the saving could be much higher, with CHF 222 (26%). Looking at the recommendation 52 days before, if he decides to book after the first change he will lose 26%. On the other hand, if he waits for the entire seven days and does not react immediately after the first change, he can save 7% (CHF 49). Passengers who book most likely one month before departure still have the possibility to save a certain share. 28 days prior, Kayak recommended waiting. The price decrease after the first change amounts to CHF 280, which corresponds to 33%. This 33% is the maximum possible saving on the Montreal flight. Waiting for 7 or 14 days pays off with a saving rate of 6% and 12%. Recommendations later than one month were not available.

The situation with the Punta Cana flight looks very different. In many cases, the recommendations even lead to a price increase. Passengers booking two months before the flight will see the recommendation to book. However, 52 days before departure the first recommendation appears. For the waiting time of seven days, there is the possibility to save either 4% or 8%, which corresponds to CHF 35 or CHF 77. Passengers who wanted to book the flight one month (27 days) before departure and would wait for the recommendation would only be able to save 5% on the first change. On the other hand, the seven days waiting time would not pay off and result in an increase of 5%. Even worse would be the situation with the booking date two weeks before departure. In the worst case, a price increase of 19% could result. The best case, if actually waiting for 14 days, ends with the same amount as at the beginning. Moreover, reacting to the first change ends in an increase of 13%. The maximum amount of savings could be reached one week before departure. If the guests are willing to wait until two days prior to departure, they could save 16% (CHF 156). Since very few passengers actually book one week before departure, only a small amount can profit from this recommendation. Of course, the question emerges whether the customer really waits until two days before departure and has a higher risk that the flight could be fully booked. If they react after the first change, they will face a price increase of 5%. The Punta Cana flight ultimately shows that the probability for the airline is higher to have even a higher revenue than a loss. Therefore, they would profit from the recommendations, assuming that at any time of booking aside from one week before the same number of people would respond to the recommendation and wait, and a 4% profit would ultimately result for the airline. This percentage would be even greater in the scenario that seven days is awaited, excluding the price reduction of 16% a week before departure. This would result in an increase of 16%.

Tampa finally shows a completely different picture. 54 days before departure and a waiting period of seven days ends in a price reduction of 31 % (CHF 298). If the guests book one month before departure (28 days), this could be the date with the largest saving amount of 43% (CHF 410). This amount results after the first change. Waiting for 7 or 14 days ends with a price reduction of 7% and 31% respectively. In summary, on this flight, profits for the passengers can be very high. Overall, after the first change this could be 74%.

Overall, no clear relationship is visible, except for European flights. On these the possibility for recommendations is quite low. A reason could be that only price changes more than CHF 21 should be recommended; therefore, the changes were below this amount. Long-haul frequently had recommendations two months before departure. Often these resulted in a price decrease. Only for one flight, recommendations for the booking date two weeks or even one week before departure were given. Overall, out of 13 flights, for one destination the recommendation would lead to a higher profit for the airlines; three flights had no recommendations and three flights had a recommendation but no price change. For the other six – which reflects about 50% – the possibility for a loss for the airlines exists, but also with a different saving percentage, especially New York and Tampa.

However, it is important to note that depending on the time of booking more or less people book. In addition, they must search for the flights on specific days. Partially, three days later may lead to another recommendation. What also plays a significant role is how people respond to the changes: Are they waiting? Do they book after the first recommendation? How long are they ready to wait? The scenario – which includes the booking after the first change – can be weighted more heavily as it involves several people. This means that anyone who is willing to wait two weeks or even longer but still reacts to the change is included.

Kayak not only offers the information of book or wait; moreover, it is also connected with a graph showing the future development of the prices. However, looking at these it is visible that they have a much higher volatility displayed than in reality. It must be mentioned that this graph was not clearly understandable, as it could be a display of the next seven days or even more. Ultimately, this graph was more irritating than helpful. The connection with the above-mentioned calculation can be made. When the prices decreased, the graph was correct in a certain way. Meanwhile, Kayak has changed this appearance as the chart is no longer available.

### **Google Flights**

At the beginning of the experiment, it was recognized that the recommendation from the search engine Google Flights does not exist. Tests have shown that this information is only available for American flights, but not for others. This is the reason why flights on Google Flights were primarily searched and saved with the filters with the exact date. Therefore, the daily mail at the beginning was only sent for general Swiss flights for the whole days. The experiment shows that Google Flights generates statistics for all subscribed flights. In this diagram, the price development of the various flights is very clearly visible. It also turns out that on certain flights the start date of the statistics was already further back. This means that all data was saved and is now visible to the user as soon as this flight has been subscribed.

As mentioned, during the experiment, it emerged that individual flights can also be observed. With specific flights, Google sent notification mails with general and specific flight information. However, what is especially important for this experiment is the announcement sent when the price is likely to increase to a much higher price. These predictions were examined based on the received mails.

Within the 17 days, six emails with announcements were received. The comparison between the predicted and the actual price changes clearly demonstrates that all notices were correct, with minor deviations. Although European flights were also observed, no announcements were sent. A possible reason could be the steady slight price increase. However, it must be considered that the function was only available from April 30, 2017. It was discovered 17 days before the end of the experiment. 21

reports would have been possible with price changes over CHF 100. Only seven were reported to the test person, reflecting exactly one third.

Due to the late discovery of this feature another test was carried out. For the results after May 17, 2017, it was decided to observe further flights with additional destinations and receive the recommendations. As a sample other destinations were chosen with various departure dates. On the day of the message, which was normally sent at 1am, the prices were checked on the homepage of Swiss International Air Lines. The check times vary between different day times. On the following day, the price was checked again on the Swiss homepage. The second experiment ended on July 29, 2017.

It showed even more clearly that all upcoming price changes were correctly predicted. Again, for the European flights there were no predictions.

In conclusion, long-haul flights of Swiss International Air Lines were correctly foreseen, while short-haul flights did not prompt any announcements. In addition, the announcements are made only about one month before departure. Earlier recommendations were not given. This fact is reflected within the survey. Most of the persons who know the function book their flights near to departure date. Most of the announcements resulted in an increase of more than CHF 100. However, for European flights some price increases of more than CHF 100 would be apparent.

To sum up, three different portals were crucial in this experiment. While Kayak has an ongoing-recommendation of price decreases that is specific for each flight date, Momondo offers simply an overview of the best day to book for the route, although this is not specific for a flight date. It includes all flights of all airlines for one route. Finally, Google Flights do not predict price decreases but focus on price increases for the next day. The differences in the results are significant. Google Flights was correct in all the predicts, but not all the possible price increases were announced. Kayak was precise in most of the predictions, but still a few questions remain to assume an influence, such as the reaction of the customers. Especially the medium concerning how the passengers observe the price changes and how they react on price changes are crucial for the evaluation. With the price overview, Momondo can be seen as the portal with the poorest results. However, only the day before departure was part of the experiment. The other functions were not evaluated. Therefore, it can be seen that at least two of the three portals are useful for the passengers to find a cheaper flight or avoid expensive flights. However, the sample only comprises a few flights; therefore, a reliable conclusion cannot be taken.

## 5. Conclusion

Due to the above-mentioned results and taking into account only the experiment and the survey, an influence on the airline industry can basically be seen. However, this statement must be discussed in consideration of various aspects. At the beginning it has to be mentioned that the discussion points are often based on assumptions.

### 5.1 Aspects to consider

#### Competitors

In the experiment, the price changes were only analyzed with one airline. However, competitors must also be included. Especially with booking portals, people are often not limited to one specific airline. This is also reflected by the survey, as the importance of the Swiss airline is not high in the decision-process. The booking portals show a selection of different airlines. Therefore, of course the price change could lead to the fact that on the day of recommendation, Swiss International Air Lines was the cheapest and seven days later Air France offered a lower price compared to Swiss, although this tariff also declined. From this view passengers, can profit from even higher price reductions. Hence, the possibility exists that the customer selects Air France rather than Swiss. Conversely, the reverse is also true. Therefore, there are winners and loser airlines in every booking. In this paper, the observations were made independently of competitors, which is the reason why this point cannot be assessed.

## **Volume**

The volume is an aspect that can minimize the impact. If the prices are lower, there is a possibility that the number of bookings increases. People who otherwise book EasyJet or even do not fly will consider Swiss as an alternative. Consequently, the number of bookings can increase. Therefore, it is necessary to weigh whether the increasing volume is greater than the loss due to lower prices. An exploration of this viewpoint is hardly possible. In order to analyze this, the click rates of the various portals must be available to ascertain whether there is actually more traffic and more clicks on these flights. However, since these portals offer millions of flights, this can hardly be done. Furthermore, the number of competitors differs depending on the destination. Nevertheless, the price elasticity can be used to analyze the impact of this aspect in a certain way. With a high price elasticity, especially the demand can vary disproportionately. Therefore, it can lead finally to an increase in profit. Though, it is necessary to distinguish between the different price elasticity of the segments. Consequently, the flights have to be analyzed according to this. For a whole network, it is difficult to draw a conclusion. Based on the results of the survey and the literature it can be assumed that the price is a crucial factor, thus the price elasticity rather high. Consequently, this would lead to a decrease of profits.

## **Sudden frequency of bookings**

A further point that shall not be underestimated – especially against the risk – is the system of revenue management. If many passengers rely on the recommendation and want to book all at the same time, there is a possibility that the price will increase, thus becoming higher than at the beginning of the observation period. Hence, some people who have missed booking the flight – for example, those who would wait for the whole seven days – need to pay a higher amount. This is due to the fact that only a certain number of tickets are available for a particular booking class. This aspect needs to be included especially if the users will heap up. Therefore it is of high importance to consider how much influence they can have in the future. As a result, the risk can be kept somewhat limited. In the case of missed bookings, the competition again plays a significant role. If the price of one airline increases, another can profit. Therefore, those who missed the booking might change to a different airline, which is a more favorable option than booking a more expensive flight than at the beginning of the waiting period. A detailed investigation is hardly possible, as it is such a complex system. In addition, it must be known how customers behave in such situations and whether the competitors have lower offers.

## **Booking behavior**

Another argument that needs to be verified, includes the behavior of passengers when booking a flight. The questions were hypothetically answered by all the participants and the result was clear, namely that most people would respond to the recommendations and wait. However, whether they would react the same in a real-world situation is questionable, especially concerning the duration of waiting and the reaction of price changes, as already mentioned. It also depends on the time passengers invest for the search inquiries and the date they starting to look for the flights. From the experiment it is visible that mostly recommendations are given at the beginning, approximately two months before departure and shortly before. Moreover, preferences of passengers similarly play a certain role such as preferred schedule or airline. The experience on the other side – especially for strategic customers – might have an influence. Previous negative experience will reduce the likelihood of future use, as shown by a study of Caliphos & Bartke (2011). However, this is contradicted by the survey that shows that those persons who have negative experience would continue to use the function. In addition, the mobile use should also not be completely neglected as this share is increasing and the booking recommendations are not available yet through this medium. For certain destinations such as Punta Cana, it can be assumed that the share of package travel is large. For these package tours, there are currently no booking recommendations. However, this share is also decreasing due to the development of individual travels in recent years. Therefore, the outcome is highly dependent on the booking behavior of passengers.

## 5.2 Summary

In summary, it can be said that at the present time especially with the number of users, there is no threat for the industry. Though, assumed that the development of the portals continue and people get to know the functions, it can be considered as a small risk, although it does not destroy the whole industry. The passengers are basically willing to wait, as it was visible through the high number of people in the survey. In addition, the price is often the most important criterion in Europe. With these facts, it is likely that the number of strategic customers might increase. Many of the functions such as price alerts or the details of the delay assists customers in finding the cheapest fare. A clear answer is since the situation for different destination varies, not possible. Moreover, a differentiation between short- and long-haul flights is unavoidable. Danger with short-haul flights can be excluded at this time if prices continue to be on the same scale in the future, as there are only a few price changes on these flights.

As the discussion has shown, there is no need for action at present. However, certain approaches should be developed by the full service carriers, which can be used proactively in the future and avoid the danger from emerging. As this is just a supplement part of this paper, it is only not mentioned any further.

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