IMPROVEMENT OF TAROM ACTIVITY BY OVERBOOKING POLICY

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ABSTRACT
The purpose of this article is to highlight the need for overbooking policy application in an airline. For this we conducted simulations to highlight the effect of overbooking policies on company revenues, and in our case we consider the example of OTP-IAS, considering the flights that require application of overbooking policy only flights with a load factor over 90% during 2012. Overbooking means deliberate booking confirmation for a larger number of seats than the physical capacity available in an aircraft.
In this way it seeks compensation for situations where some passengers ticket holders fail to reach the flight, therefore they are declared missing at the time of the flight. In aviation terminology, are called "no show" passengers

KEYWORDS: *management, overbooking, TAROM.*

JEL CLASSIFICATION: *M10, M16*

1. INTRODUCTION

Airlines practice overbooking policy to increase cargo flights and to use the maximum available capacity (Belobaba, 2009). These overbooking policies are based on estimates of computer systems that make predictions based on last minute cancellations and no-show rate for passengers and airline-specific criteria
Thus overbooking policies can be divided into three categories:
Aggressive policies; every flight with a high demand is overbooked over the estimated level of no-shows, statistical probability of having passengers which can not be embarked is high but the overbooking revenues cover the costs of rerouting passenger in question (the rates for overbooked passenger tickets are sold at the top of the grid, far above average).
Companies which may engage in such aggressive policy generally have several flights for that destination and can reroute passengers on its flights with minimal discomfort for them and with a minimum cost to the company, also companies that have a high volume of traffic connection can practice such a policy covering the risk of delays or loss of connection (Doganis, 2001). Conservative policies, airline flights are slightly overbooked, well below the estimate of no-show, the statistical probability of having passengers rerouted is very small and occurs only in extreme situations, companies using such policies don't have costs for rerouting passengers;
Overbooking balanced policy, in this case is considered both evolution of late bookings prior to the date of operation and no-show rate and maintain a booking balance within these parameters
Since using statistical data, there is a risk that, in certain situations, overbooking is not reduced by the time of flight and therefore be required rerouting passengers.
The overbooking limit, which is also referred to as virtual capacity or total booking limit, is the maximum number of booking requests an airline company is willing to accept. An allocation policy

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specifies how to allocate this virtual capacity to each fare class (Robinson 1995).

The criteria underlying this policy of overbooking are:

a) Business Class should not be overbooked; passengers using this class represents less than 3% of total income TAROM passengers but produce about 10% of total revenues, the program is very important for such passengers they are and paying a substantially higher price in order to ensure the place booked.

b) Periods of high demand during holidays (Easter and Christmas) will also be treated separately by applying a policy less aggressive than the rest of the year given the lower probability of having no-shows and the difficulty of rerouting such passengers in this period. Peak summer season will be the main beneficiary of this new policy of overbooking. All overbooking will be made exclusively for high fare classes, S (the highest economic class cabin) so the sales by the overbooking to cover and exceed the costs of any diversions.

c) From an operational standpoint, the first phase will overbook the seats in Economy Class, S in the capacity available in Business Class, without closing the sale this class, according to estimate the evolution of sales and selling business class (Shaw, 2011).

d) If sales in Business Class Sales not evolve positively, it will continue selling the upper classes in Economy up to 5% above the maximum capacity of the aircraft, depending on the specific flight.

2. OBJECTIVES, HYPOTHESIS AND RESEARCH METHODOLOGY

2.1. Objectives:

The main objective of the research is to find a more efficient overbooking method than the currently used.

2.2. Hypothesis:

a) Overbooking policy is a very important procedure in the Revenue Management System, which directly influences the company's revenue.

b) Overbookin policy implementation can generate income and increasing the load factor of the company.

2.3. Research methodology:

For application below the methodology used is an empirical study based on binomial model ans historical informations to find new solutions to improve overbooking policy.

3. OVERBOOKING POLICY

Currently TAROM overbooking policy is generally airline flights being sold at full capacity and possibly a little over the capacity of Economy class seats, in Business Class account. Cases where it exceeds the entire capacity of the aircraft are very rare. The results of this policy are obvious, cases of non-acceptance on the flight (Denied Boarding) due to overbooking were only relatively few. The compensation paid by TAROM was relatively small (for departures from OTP were paid 16,400 EUR in 2011, 18,700 EUR in 2012. Overbooking is the practice of selling more seats to the capacity available in order to offset the effect of the cancellation and no-show passengers currently occurring. (McGill and van Ryzin 1999). Without it, it is estimated that although the ability of a plane is fully booked before departure, 15% of the seats were empty. Some airlines allow reservation cancellation without applying penalties. On average, about half of the bookings made for flights are canceled or passengers do not show. As a result, bad decisions on overbooking (ie those that do not take into account the benefits of overbooking and don't make those overbooking) can be very costly. On the other hand, the airline should try to evaluate overbooking price. If the airline refuses to give a passenger the right place, despite having a valid ticket oun, this can have an impact over time. At the moment, it just loses ticket related revenue remained unsold and regulated related compensations, but long-term implications include passenger loyalty and reputation of the

airline. U.S. airlines have developed a model of automation that maximizes net revenues associated with overbooking decisions. This model measures the marginal revenue obtained when booking regardless of cost, risk or implications of overbooking (Peteraf and Reed 1994). Net income increases with overbooking made to the point where these costs exceed the proceeds overbooking. Costs for overbooking made have gowns rapidly with increasing number of overbooking, because at a certain point, increasingly fewer passengers are willing to change their travel arrangements..
For airlines, the capacity is predetermined, so when the flight is concluded and when the flight to beconducted, unsold seats can not generate income anymore. Airlines use a fine-tuned revenue management system to monitor the way in which a number of seats is reserved and can react accordingly.
There are various ways to control the inventory of flights, for example, can provide discounts for low demand flights, it is evident that these flights will not be sold. The converse is true, namely, management of demand: when demand is high we will have more seats sold at a high price. Another way to get the availability of payment is the market segmentation. (Netessine and Shumsky, 2002).
A company may convert the product or the basic service into different products, for this purpose. For a flight, this means implementing purchase restrictions, the fees for changing or canceling tickets or reservations.
The company must ensure its additional capacity specifically designed to meet a potential demand for high fare seats, so this method increases the revenue per flight (Bijan et al., 2008) . This process can be managed through strict controls of inventory availability through strict management of applied fares, Such as time restrictions (advanced purchase) place restrictions or the possibility to change the date of travel.
The price of each ticket varies inversely with the number of seats reserved, the fewer seats reserved for particular category, the seat price is getting lower (Dinu, 2011). Companies that use yield management system, most often use computerized methods to streamline operations.

4. CASE STUDY: IMPLEMENTATION OF OVERBOOKING PROCEDURE ON OTP-IAS TAROM FLIGHTS

For this we conducted simulations to highlight the effect of overbooking policies on company revenues, and in our case we consider the example of OTP-IAS, considering only flights that require application of overbooking policy, only flights with a load over 90% during 2012.(www.tarom.ro accessed on 21/05/2013).
We model the expected revenue as a function of the overbooking strategy for the plane, and find the revenue-maximizing strategy.
We assume that the plane has capacity of A identical seats. This assumption is relaxed later, when we consider a multi-fare model. We assume also that a ticket costs T = 123 EUR at the moment when the overbooking is necessary to be made. Finally, we assume that the airline's overbooking strategy is to sell up to B tickets, if possible (B > A).We analyze this strategy in the case where the flight sells out completely (i.e. all B tickets are sold). Analyzing this case is one of the most direct ways to gauge the effectiveness of the company's overbooking strategy.
We model the number of contenders for the flight with a binomial distribution, where a ticketholder becomes a contender with probability p. Note however, that the p value for a particular flight depends on a host of factors - for example, flight time, length, destination, and whether it is a holiday season. Because of the potential p variation from flight to flight, we carry out our analysis for a range of possible p values: 0.8 for conservative policy, 1 for balanced policy and 1.2 for aggressive policy. However, a real airline company has, or could easily obtain, an empirical value of p for any particular flight.
With our binomial model, the probability that there are exactly i contenders among the B ticket holders is:

$$\binom{B}{i} p^i (1-p)^{B-i} \quad (1)$$

Next, we model compensation costs. We assume that each bumped passenger is paid a constant compensation cost of (k + 1) T = 123(k + 1), for some positive constant k (Shumsky, 2006). Translated into everyday terms, this means that a bumped passenger receives compensation equal to his ticket price and then some additional compensation kT > 0. The assumption that compensation cost is constant for each bumped passenger is relaxed later, when we consider involuntary versus voluntary bumping. We define the compensation cost function F (i, A) to be the total compensation the airline must pay if there are exactly i contenders for a flight
with seating capacity A:

$$F(i,A)=\begin{cases} 0 & i \leq A \\ (k+1)T(i-A) & i \geq A \end{cases}$$

With the results we have so far, we now calculate expected revenue, R, as a function of the overbooking strategy B:

$$R(B) = \sum_{i=1}^{B} \binom{B}{i} p^i (1-p)^{B-i} \left(BT - F(i,A)\right) \qquad (2)$$

$$R(B) = 123B - 123(k+1) \sum_{i=A+1}^{B} \binom{B}{i} p^i (1-p)^{B-i} (i-A) \qquad (3)$$

In Table 1 we find the following data:

Flight number - is the flight number operating on the route.
Time of flight - represents the date on which the flight is scheduled.
Origin & Destination - gives us information about the city of departure flight (in our case the origin is the hub company) and about the city where the flight ends (in our case the destination is the secondary hub of the company).
Capacity - it gives us information about the available space of the aircraft, indicating the number of places available.
Forecasted load factor -is an index obtained from relevant historical data (date, day of week, and season) and indicates proportion in which it is possible to cover the aircraft capacity.
No show registered - represents the number of registered passenger on a flight which were not in the airplane, until the airplane takeoff.
No show (%) - the number of no show is recorded in relation to the percentage of aircraft capacity.
Aggressive overbooking - is calculated as the product of a coefficient determined by it (in this case I decided to be 1.2) and the number of no show recorded.
Balanced overbooking – it is calculated as the product of a pre-established coefficient (which in this case I decided to be 1) and the number of no show recorded.
Conservative overbooking - is calculated as the product of a coefficient set (which in this case I decided to be 0.8) and the number of no show recorded.
In the table 1 we find only flights that have a forecasted load factor over 90%, predicted since 2012, only requiring overbooking policy application. The three methods of policy (aggressive, balanced and conservative) were determined based on historical data provided by TAROM. So based on calculations we identify the optimal method to maximize the company's revenue.
For aggressive policy, we calculated using the formula:

pre-established coefficient (1,2) x number of no show recorded;

We obtained for the entire sample of flights a total of 142.8 approximating it to 143 seats sold additional as overbooking.
For the Balanced policy we used the formula:

pre-established coefficient (1) x number of no show recorded;

We obtained for the entire sample of flights a total of 119 additional seats sold as the overbooking.
For the Conservative overbooking we used the formula:

pre-established coefficient (0,8) x number of no show recorded;

We obtained for the entire sample of flights a total of 95.2 approximating the 95 seats it sold additional as overbooking.

Table 1: Flights that require overbooking policy application and type of overbooking applied

Flight number	Flight date	Origin& Destination	Capacity	Forecasted load factor (%)	No show registered	No show (%)	Aggressive over booking	Balanced over booking	Conservative over booking
701	09.01.2012	OTP-IAS	46	102.17%	0	0.00%	0	0	0
707	08.01.2012	OTP-IAS	46	98.26%	3	6.25%	3.6	3	2.4
709	08.01.2012	OTP-IAS	68	100.00%	1	1.45%	1.2	1	0.8
701	15.02.2012	OTP-IAS	46	89.13%	13	25.49%	15.6	13	10.4
703	15.02.2012	OTP-IAS	46	91.30%	18	32.73%	21.6	18	14.4
701	22.03.2012	OTP-IAS	46	93.48%	5	10.64%	6	5	4
709	30.03.2012	OTP-IAS	46	97.83%	3	6.25%	3.6	3	2.4
709	27.03.2012	OTP-IAS	46	104.35%	1	2.13%	1.2	1	0.8
701	11.04.2012	OTP-IAS	46	104.35%	1	2.04%	1.2	1	0.8
701	04.04.2012	OTP-IAS	46	104.35%	4	8.16%	4.8	4	3.2
707	22.04.2012	OTP-IAS	46	100.00%	1	2.13%	1.2	1	0.8
709	27.04.2012	OTP-IAS	100	98.00%	6	5.77%	7.2	6	4.8
709	24.04.2012	OTP-IAS	46	95.65%	3	6.38%	3.6	3	2.4
709	17.04.2012	OTP-IAS	46	104.35%	0	0.00%	0	0	0
709	13.04.2012	OTP-IAS	46	102.17%	0	0.00%	0	0	0
709	10.04.2012	OTP-IAS	46	104.35%	3	6.25%	3.6	3	2.4
709	04.04.2012	OTP-IAS	46	102.17%	1	2.08%	1.2	1	0.8
711	27.04.2012	OTP-IAS	68	100.00%	2	2.86%	2.4	2	1.6
709	29.05.2012	OTP-IAS	46	102.17%	0	0.00%	0	0	0
709	17.05.2012	OTP-IAS	46	95.65%	3	6.38%	3.6	3	2.4
709	10.05.2012	OTP-IAS	46	102.17%	1	2.08%	1.2	1	0.8
709	04.05.2012	OTP-IAS	46	100.00%	1	2.13%	1.2	1	0.8
709	29.06.2012	OTP-IAS	46	102.17%	2	4.08%	2.4	2	1.6
711	29.06.2012	OTP-IAS	46	102.17%	2	4.26%	2.4	2	1.6
705	27.08.2012	OTP-IAS	46	95.65%	6	12.00%	7.2	6	4.8
701	17.09.2012	OTP-IAS	46	104.35%	1	2.04%	1.2	1	0.8
703	27.09.2012	OTP-IAS	46	97.83%	3	6.25%	3.6	3	2.4
703	24.09.2012	OTP-IAS	46	104.35%	2	4.26%	2.4	2	1.6
705	28.09.2012	OTP-IAS	100	100.00%	1	0.99%	1.2	1	0.8
705	21.09.2012	OTP-IAS	46	104.35%	0	0.00%	0	0	0
705	20.09.2012	OTP-IAS	46	95.65%	4	8.33%	4.8	4	3.2
707	23.09.2012	OTP-IAS	46	104.35%	0	0.00%	0	0	0
709	15.09.2012	OTP-IAS	46	100.00%	5	9.80%	6	5	4
711	28.09.2012	OTP-IAS	46	95.65%	3	6.38%	3.6	3	2.4
711	21.09.2012	OTP-IAS	46	102.17%	0	0.00%	0	0	0
701	05.10.2012	OTP-IAS	46	97.83%	3	6.38%	3.6	3	2.4
701	04.10.2012	OTP-IAS	46	102.17%	3	6.38%	3.6	3	2.4
703	13.10.2012	OTP-IAS	46	102.17%	4	7.84%	4.8	4	3.2
709	11.10.2012	OTP-IAS	46	95.65%	5	10.20%	6	5	4
711	12.10.2012	OTP-IAS	68	100.00%	1	1.45%	1.2	1	0.8
701	26.11.2012	OTP-IAS	46	102.17%	1	2.13%	1.2	1	0.8
701	23.11.2012	OTP-IAS	46	95.65%	3	6.38%	3.6	3	2.4
701	04.12.2012	OTP-IAS	46	102.17%	0	0.00%	0	0	0
			2152	**99.96%**	**119**	**5.36%**	**142.8**	**119**	**95.2**

Source: adapted from TAROM Efficiency (2012)

Table 2: Grid tariff OTP-IAS

FSD OTPIAS/RO/EUR
01 C1 / 143.00= 286.00/C/ . / /NO02R
02 S1 / 123.00= 246.00/S/ . / /NO02R
03 R1 / 36.00= 72.00/R/ . / /SP02R
04 Y1 / 103.00= 206.00/Y/ . / /SP02R
05 K1 / 46.00= 92.00/K/ . / /SP02R
06 B1 / 73.00= 146.00/B/ . / /SP02R
07 M1 / 56.00= 112.00/M/ . / /SP02R

Source: adapted from Tarom SITA tariffs

From Table 3 we observe that Tarom has a conservative policy because the number of passengers is less than capacity. The deficit is 41 seats.
Due to this deficiency, the fare with which it is recommended to make overbooking, which is the highest price in the grid, in economy class fare is "S1" meaning 123 euros, as per Table 2 (www.sita.com accessed on 21/05/2013).
Our calculations result in a potential loss of 41 x 123 = 5043 euros.

Table 3: Boarding passengers

Number of flight	Flight date	Origin & Destination	Capacity	Passengers boarding
701	09.01.2012	OTP IAS	46	46
707	08.01.2012	OTP IAS	46	36
709	08.01.2012	OTP IAS	68	68
701	15.02.2012	OTP IAS	46	41
703	15.02.2012	OTP IAS	46	42
701	22.03.2012	OTP IAS	46	43
709	30.03.2012	OTP IAS	46	45
709	27.03.2012	OTP IAS	46	46
701	11.04.2012	OTP IAS	46	46
701	04.04.2012	OTP IAS	46	46
707	22.04.2012	OTP IAS	46	46
709	27.04.2012	OTP IAS	100	98
709	24.04.2012	OTP IAS	46	44
709	17.04.2012	OTP IAS	46	46
709	13.04.2012	OTP IAS	46	47
709	10.04.2012	OTP IAS	46	46
709	04.04.2012	OTP IAS	46	46
711	27.04.2012	OTP IAS	68	68
709	29.05.2012	OTP IAS	46	46
709	17.05.2012	OTP IAS	46	44
709	10.05.2012	OTP IAS	46	46
709	04.05.2012	OTP IAS	46	46
709	29.06.2012	OTP IAS	46	46
711	29.06.2012	OTP IAS	46	46
705	27.08.2012	OTP IAS	46	44

Number of flight	Flight date	Origin & Destination	Capacity	Passengers boarding
701	17.09.2012	OTP IAS	46	46
703	27.09.2012	OTP IAS	46	45
703	24.09.2012	OTP IAS	46	46
705	28.09.2012	OTP IAS	100	100
705	21.09.2012	OTP IAS	46	46
705	20.09.2012	OTP IAS	46	44
707	23.09.2012	OTP IAS	46	46
709	15.09.2012	OTP IAS	46	46
711	28.09.2012	OTP IAS	46	44
711	21.09.2012	OTP IAS	46	46
701	05.10.2012	OTP IAS	46	45
701	04.10.2012	OTP IAS	46	46
703	13.10.2012	OTP IAS	46	46
709	11.10.2012	OTP IAS	46	44
711	12.10.2012	OTP IAS	68	68
701	26.11.2012	OTP IAS	46	46
701	23.11.2012	OTP IAS	46	44
701	04.12.2012	OTP IAS	46	46
			2152	**2111**

Source: adapted from TAROM Efficiency (2012)

As follows:
To apply aggressive policy would have obtained additional income from the sale of the 143 seats for the price of 123 euros, thus obtaining 17 589 euros.
For the application of balanced policy would have obtained additional income from the sale of the 119 seats in the 123 euros rate, thus obtaining 14637 euros.
To apply conservative policy would be additional income obtained from the sale of the 95 seats for the price of 123 euros, thus obtaining 11685 euros.

4. CONCLUSIONS

In our opinion, we have highlighted a few conclusions:
1. Always the most profitable solution is the riskiest, but the airline must be open to allocate it, in order to aim the highest revenue.
2. Small deviations from the optimal overbooking strategy can easily result in huge financial losses in fairly short order.
3. If too many passengers are bumped, then there will be a loss of goodwill and many regular customers could be lost to rival airlines.

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