

The impact of the new EC denied boarding compensation regulation on airline overbooking

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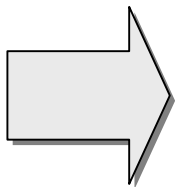
- **Overbooking and revenue management**
- **EC denied boarding regulation**
- **A simple overbooking model**
- **Empirical results**
- **Conclusions**

Overbooking and revenue management



Overbooking	Deliberate policy of selling more seats than the capacity on a given flight to compensate for passengers failing to show up at departure
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Lufthansa in 2004	5.5 million no-shows (i.e., 14,000 full Boeing 747) Overbooking allowed Lufthansa to carry more 640,000 additional passengers
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Overbooking is not only one of the oldest revenue management techniques but also one of the most powerful!

EC denied boarding regulation



- ➔ On 17 February 2005 a new EC regulation 261/2004 to protect the rights of air passengers in the event of denied boarding (DB), delays and cancellations entered into force repealing a weaker regulation dating from 1991

- ➔ The new EC regulation applies to passengers departing to and from an airport located in the territory of a member state

- ➔ Passengers who have been involuntarily DB have 3 rights:
 - ➔ Choice between alternative flight and reimbursement of ticket,
 - ➔ Care while waiting (refreshments, meals, hotel, etc.),
 - ➔ Financial compensation

EC denied boarding regulation

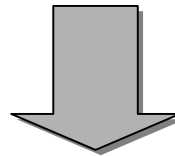


Financial compensation: Every passenger who is denied boarding is entitled to a minimum compensation:

- **€ 250 for all flights $\leq 1,500$ km,**
- **€ 400 for all intra-Community flights $\geq 1,500$ km,
and for all other flights between 1,500 km and 3,500 km,**
- **€ 600 for all other flights**

Flight distance	Old DB compensation	New DB compensation
$\leq 1,500$ km	€ 150	€ 250
1,500 km – 3,500 km	€ 150	€ 400
$\geq 3,500$ km	€ 300	€ 600

In comparison to the previous regulation, the European Community has significantly increased the minimum compensation amounts!



How does this affect the overbooking policy of Lufthansa and other network airlines?

A simple overbooking model

Objective	Find flight specific overbooking limit that minimizes sum of expected spoilage and oversales costs
Modeling approach	News vendor framework (see e.g. Bodily and Pfeifer, 1992)
„Reality“	Airlines like Lufthansa apply sophisticated forecasting tools that analyze individual bookings to calculate flight specific overbooking limits
„Simplicity“	„Real world“ models add complexity and details not needed to tackle the basic question at issue

A simple overbooking model



Increase bookings from **B** to **B+1** if the following condition holds:

$$(1) \quad P(S \leq N) \cdot R - P(S > N) \cdot C = P \cdot R - (1 - P) \cdot C > 0$$

where

R = contribution (equal revenue less variable costs) = spoilage costs

C = cost penalty of an involuntary denied boarding = oversales costs

S = survivals, i.e., bookings **B** that show up at departure

N = physical seat capacity

$P(S \leq N)$ = probability of spoilage

$P(S > N) = 1 - P(S \leq N)$ = probability of oversales

A simple overbooking model

Solving (1) leads to the decision rule

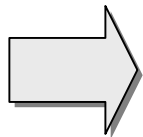
$$(2) \quad P > \frac{C}{C + R}$$

where P is probability of spoilage if bookings are curtailed at B

Surviving bookings as a binomial process

Let λ be the probability that a booked passenger survives, i.e., actually shows up for the flight

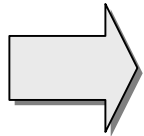
Assume that λ does not depend on when the booking was made, and that booking survivals are independent of one another



Binomial process for the number of bookings that survive,
with mean $\lambda \cdot B$ and variance $\lambda \cdot (1 - \lambda) \cdot B$

A simple overbooking model

Normal approximation to binomial



Decision rule:

$$(3) \quad \Phi = C / (R + C) + \phi(1 - \lambda)^{1/2} / [2 \cdot (B \cdot \lambda)^{1/2}]$$

where ϕ unit normal probability density function

Φ left-tail unit normal cumulative distribution function,
both evaluated at $(N - B \cdot \lambda) / [B \cdot \lambda \cdot (1 - \lambda)]^{1/2}$

(3) includes the familiar $C/(C+R)$ and a term to account for the change in variance of the probability distribution for survivals when adding one more booking

In the following calculations, the second term of (3) is not considered!

Empirical results

The decision rule $\Phi = C / (R + C)$ allows to determine overbooking limits (OBL) based on empirical values for C, R, N and λ

Optimal overbooking limits for LH on an average European flight ($\leq 1,500$ km)

<i>Scenario</i>	<i>N</i>	<i>C</i>	<i>R</i>	<i>λ</i>	<i>OBL</i>
S1	150 (A320)	€ 150	€ 120	0.895	167
S2	150	€ 250	€ 120	0.895	166
S3	150	€ 750	€ 120	0.895	163
S4	150	€ 150	€ 50	0.895	165
S5	150	€ 250	€ 50	0.895	163
S6	280 (A300-600)	€ 150	€ 120	0.895	312
S7	280	€ 250	€ 120	0.895	310
S8	280	€ 750	€ 120	0.895	306

Conclusions



<p>1. Voluntary Denied Boarding (DB)</p>	<p>EC regulation requires airlines, when expecting DB, to first call for volunteers to surrender their reservations in exchange of benefits</p> <p>Even before this regulation, airlines successfully lured passengers off oversold flights, minimizing the number of involuntary DB</p>
<p>2. Limited dissuasive impact of new EC regulation</p>	<p>The increased mandatory compensation for involuntary DB only slightly reduces optimal overbooking limits at network airlines!</p>
<p>3. Complexity of new EC regulation</p>	<p>Giovanni Bisignani, IATA Director General and CEO:</p> <p>, ... these rules are exceedingly complex to implement, impractical and likely to cause confusion.'</p> <p>, ... the provisions are likely to lead to conflicts at airports, posing problems between passengers, airlines and airport staff.'</p>

Thank you for your attention!



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