Optimizing fare structures

Practical approach based on historical observations to alleviate pricing inefficiencies

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Disclaimer

This presentation focuses on a scientific approach and provides theorical aspects, presenting various fictitious examples and data.

No commercially sensitive number will be shown.

Motivations behind the project: class-availability lever

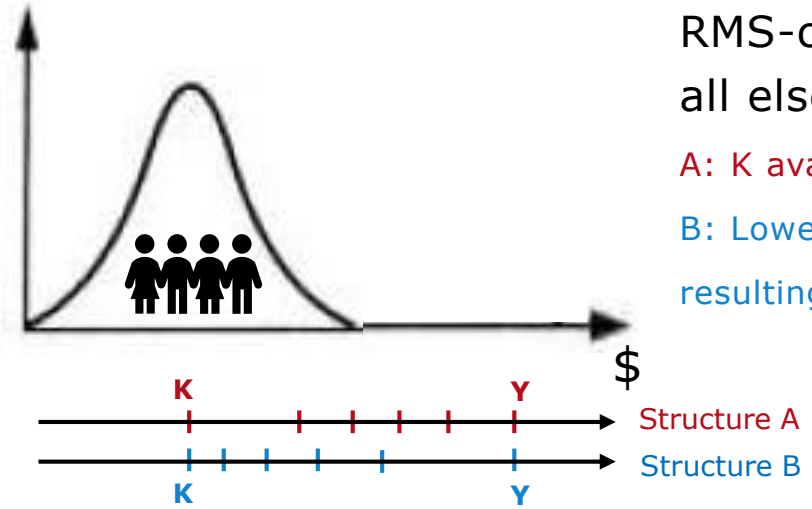
Passengers bookings

Inventory

Consumer prices

Availability per fare class

Would the RMS do a better job if we change the fare structure?



RMS-computed availability, all else being equal:

A: K available almost all the time

B: Lowest availability more variable, resulting from RMS steering

Motivations behind the project: where demand sits

When few fare classes gather most of the bookings, usually:

→ lesser ability to differentiate the demand

→ constant fare fillings and adjustments

Intuitive practices exist to rationalize the fare spread

E.g. set arbitrary thresholds per fare class on:

- Bookings
- Revenue
- Availability

Then adjust fare bands to reach this distribution…

Could the knowledge of the demand-price relationship help better define fare bands?

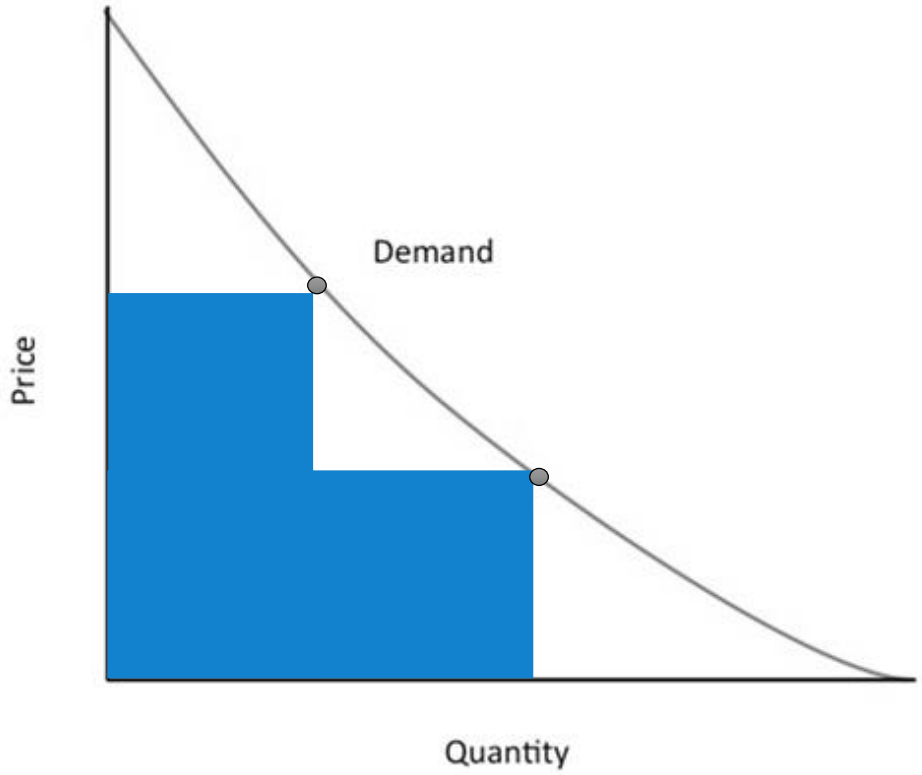
Presentation of the methodology

Back to basics: Economics 101

As price of a given commodity increases, demand decreases, all else being equal

→ The demand curve represents this relationship

→ The revenue is the area of the rectangle beneath the curve



How can we estimate the demand curve?

Cumulated demand sorted in decreasing order as proxy for the inverted demand curve

The **flown coupon database** allows to establish the relationship between fare paid and observed bookings, presented in a cumulative fashion

Process:

1. Order fares by decreasing value
2. Compute the cumulated sum of bookings
3. Detruncate/unconstrain to account for rejected demand

Fare	Bkgs	Cum. bkgs	Unc. Cum Bkgs
500	1	1	1
200	3	4	5
100	5	9	12
50	4	13	20

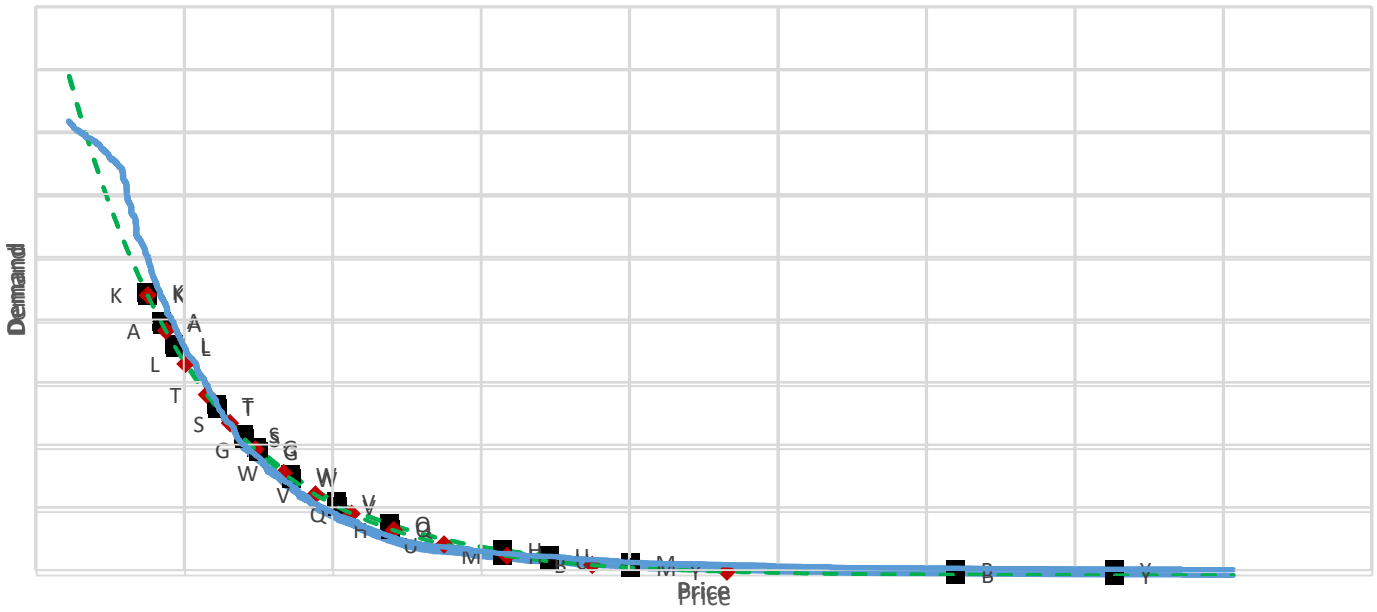
→ "Price" → "Demand"

Research hypothesis:

All the bookings* are considered similar and summable, regardless of the fare restriction or product attributes

*: see later section on the importance of data curating

From basics to full fare structure



The inverted representation corresponds almost always to a **negative exponential shape**, which simplifies the problem resolution

It is then possible to add price points on the curve to see the cumulated demand associated

Demand curve ■ Current fares ◆ Solver solution

Optimisation under constraints:

$$\max\left(f_1 d_1 + \sum_{i=1}^{n-1} d_{i+1}(f_{i+1} - f_i)\right)$$

$$\text{s.c.}\begin{cases} \forall i,j \quad i<j \quad f_i < f_j \\ Optional: \quad \alpha_k < f_k < \beta_k \end{cases}$$

"Maximize sum of rectangles beneath the curve built by the cumulated and ordered bookings"

From theory to practice

A flexible problem definition… that requires adjustments

The constraints can be used to:
- Assign a lower bound (required)
- Account for booking class value constrained by an associated product (like upgradability)

The objective function can also be changed to exclude some fare classes from the optimization process

$$\max(Potential\ revenue)$$

$$\text{s.c.} \begin{cases} RBD\ order\ to\ respect \\ Upper\ or\ lower\ fare\ bound \\ for\ selected\ classes \end{cases}$$

The coupons extracted & their aggregation are core to the final solution
→ **Data preparation and curation** ensure robust and reliable results

By default Origin-Destination/Point of commencement/Season/Cabin

Back to reality: from model to market

Current solution provides **one structure per aggregation level**

Fare restrictions are set on the side for the equation resolution

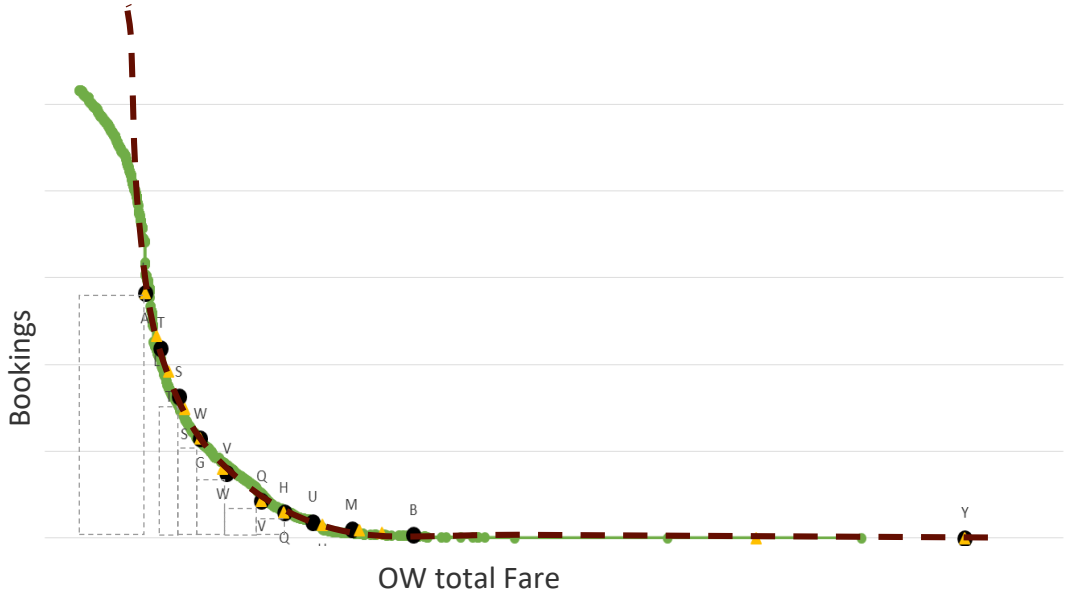
Still requires manual fare differentiation

Scientific approach under development

1. The fit with a negative exponential curve is usually not valid for low fares
2. The method is not aware about capacity limit

Constraints required to set a lower bound

Solver solution <u>very sensitive to this minimum value</u>



The solution should rather be seen as **optimized "buy-ups" or fare bands**

Outcomes and key learnings

Project outcomes

Development of an **Excel prototype**, macro-enabled file

Major gains in development time and users' learning curve

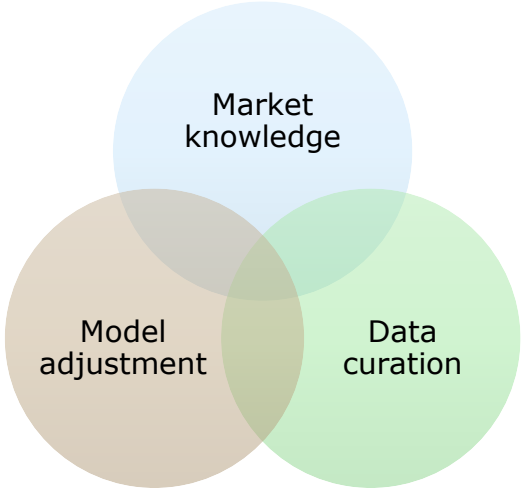
Flexible tool, in the hands of the pricing analysts

General results

- Improved capability to target "untapped pockets of demand", and fewer RBDs wasted in sub-optimal zones, resulting in fewer fare fillings
- Empowered pricing analysts, creating an actual link between demand and price
- Better spread of the mix

  E.g. bottom 3 classes used to represent 2/3 of the demand, now same amount is spread between 5 classes
- From 0.1 to 3.5% revenue improvement

Key learnings



- Solver outputs not to be linked directly to the fare filling tool

A proper lower bound, the aggregation level and the fare restrictions being core of the robustness of the solution

- As market knowledge, data and model curating are also key
- This model of the demand curve provides knowledge on market specificities and allows many scenarios to be simulated
- Post-implementation, demand curves do not change significantly despite the fare classes modifications
- The **collaborative work** during the process ensures users acceptance while **addressing market realities**

Merci !

Thank you!

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Appendix

Practical considerations – coupon extracts

Data cleaning

Keep only what is derived from published structure

Ancillary value subtracted for product homogeneity

Data filling

For missing parts of the curve, live tests can be run (special fares, promo, etc.) to assess the curve above the known boundaries

The more variable the fares were historically, the smoother the curve

Data clustering

Coupons can be clustered in various ways, depending on the homogeneity of the dimensions: key to the robustness of the solution

E.g.:

- Market profile (Origin & Destination, Point of Sale, business/leisure, etc.)
- Booking and travel date (Holiday or event, departure DOW/month, days prior)
- Fare definition (Advance purchase, minimum-stay, etc.; constructed structures)