

Yield Management

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Abstract— In this short paper we examine the meaning and appliance of yield management, also known as revenue management. The paper is partitioned in the main components of which yield management relies on. Scenarios of appliance, variants of granularity and characteristics of components are illuminated in order to provide a big picture about the potentials of this highly commended profit-booster.

I. INTRODUCTION

Strategic managers of companies in deregulated markets are confronted with the creation and sustainability of competitive advantage. When an industry's dynamics calms down by innovations not expected to foster business as a major factor, optimization of daily-business comes into play. In this scenario there are two cardinal options for action: In first place, one might downsize operations by labor and cut costs. Secondly and of greater challenge, analysts may optimize profit (yield) and revenue by elaborate pricing techniques. The former is barely more than a pure controlling activity. This lowers the hurdle to apply it for nearly every competitor and might not add to long-term economic profitability [1] as experience by National Rent-a-Car in the early nineties [2]. Going the other way, a great deal of analytical skills is required to optimize profits. This is summarized under the term yield management (YM). Its origins, history, components and methods are explained in the following chapters.

II. HISTORICAL REVIEW & OBJECTIVE

A. The Beginnings

The first time YM unleashed its effectiveness right after the deregulation of the U.S. airline market given the Airline Deregulation Act from 1978. Since fares, routes and schedules were no longer regulated; low-cost carriers entered the market and inflicted noteworthy market share loss upon established airlines[3]. American Airlines was one of the challenged suppliers. Without wanting to reposition their brand and competing for low costs, they countered by optimizing margins. This was the hour of birth to YM.

Here on YM spread throughout the hotel, car rentals and travel industry in general and event bookings. Soon it became clear, that YM is not limited to certain industries but rather to the characteristics of a product respectively service. These are illustrated in chapter II.B.

These days every master student of economics is taught YM as managerial strategy to overcome the fights for margin.

Therefore, software vendors like Oracle[4] and SAS[5] acquired companies with YM knowledge to support business intelligence (BI) analysts with instant elaborated information embedded within their software suites.

TABLE 1 – Exemplary and Promising Functionality of Oracle's Revenue Management and Billing for Banking

| Industry | Functionality |
|------------------|---|
| Banking | Increase enterprise revenue and cash flow |
| Banking | Create auditable consolidated customer bills across lines of business |
| Banking | Support complex pricing agreements |
| Banking | Manage high-volume billing cycles |
| Banking | Implement rules-based collections |
| All ¹ | Automate investigation of billing variances |
| All ¹ | Perform speedy bill reconciliation and reduce manual processing |

1) applicable under the conditions of chapter III.A

B. Purpose & Objective

A business analyst's definition could be «An internal consultancy role that has responsibility for investigating business systems, identifying options for improving business systems and bridging the needs of the business with the use of IT. » [6]. In the context of YM, the BA should sense the "need of the business" and provide a system that is capable of operational optimizations. A system that can assist to sell a product at the right time, right place, right price and to the right person [7]. A competent revenue management analyst (RMA) operating such a system, then, may elevate yield in the magnitude of thousands of CHF per hour. In other words a RMA is anticipating and influencing consumer behavior in order to maximize profits. Speaking in accounting, we fully exploit capacity utilization [8]. Doing so, the contribution margin is at its limit and thus at the best. If this doesn't result in economical profit within a given period and under the assumption that unit cost is higher than the retail price, managers must increase capacity or reduce fixed costs.

From marketing, in particular customer relationships management (CRM), we know how to identify the "right person" and segment them to group resp. classes. CRM also provides "the right product" those groups are interested. We combine them by applicable patterns. Now, YM is expected to determine the right time and place. E.g. a ticket/seat in a timed transportation service. Combining these 4 factors with – supported by CRM and YM – strongly increases the likelihood for attracting the maximum customers capable (full capacity utilization) with best individual and variable prices computed by a centralized system. As a consequence, pricing turned out to be a management activity [9].

From this parameter-intensive objective of combinatorial optimization, we derive an individual equilibrium of price and demand by two conditions:

- We wait as long as possible for consumers not sensitive to prices, with high contribution to profit margin.
- We minimize the risk of not leveraging capacity.

Considering these two conditions, we always make the assumptions that a Nash Equilibrium (NE)[10] cannot be reached, because not all competitors may mobilize analytical excellence. Furthermore we assert that dynamic pricing will affect market shares but – and very important – will not create significant downward pressure on the market price, which would equalize YM efforts.

The next chapter discloses the essential elements of YM and discusses the aspects of pricing under these assumptions.

III. COMPONENTS

A. The Three Major Condition for YM-appliance

YM is not suitable for every sales scenario. Researchers have distinguished three common characteristics [11] that must hold true within a period of sale t .

1) The product is perishable

The product unit loses all its full value once t is expired and no customer bought-in.

2) A fixed number of product units

A capacity is given and cannot be enlarged, nor reduced in t .

3) Different prices for same product

The segmentation of consumers allows price discrimination; exhausting the very maximum a customer is willing to pay in t . Optimally, it represents the consumer's individual valuation of the added-value provided by the customer.

Overlooking one or more of these characteristics easily results in an idle state or could even backfire in terms of customers dissatisfaction described in chapter IV.B.

B. Protection – illustrated in the airline industry

1) From uniform to exponential pricing

In times where prices, for example, in the airline industry were uniformly distributed as shown in Fig. 1, different demands of consumers were not considered and leveraged. Suppose the demand is the customers budget.

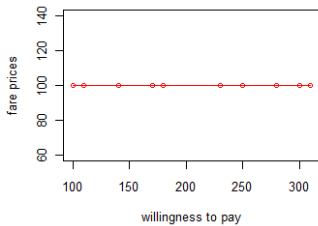


Fig. 1 - Uniformly distributed prices before YM

With the arrival of YM profit-oriented organizations exploited the high demands by computing prices for individual needs. As an objective, the profit of a so far price-

uniform product, should be augmented without adding more effort, but still creating a Unique Advertising Proposition (UAP) [12]. The UAP creates the opportunity to advertise low-price fares with good quality, accompanied with the fact, that late bookers pay disproportionately more.

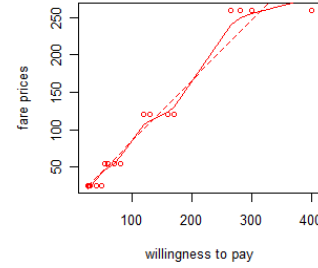


Fig. 2 - Disproportionately distributed pricing

It's a common and initial task to divide the available seats – of homogenous quality - into contingents [13]. Consumers with different demands are, in this example, then assigned to a fare price of a specific contingent class depending on the time of request. Instead of taking discrete agglomerated data, we could also continuously assign prices. This, of course, requires a real-time data connection[14] to the central system. Otherwise we run the risk of under pricing fares at the edge from one to the next class. It goes without saying, that we give away expensive seats to lower fares if there is no hope for enough consumers of that higher class. However, remembering the individual equilibrium of price and demand in chapter II.B, we must protect upper classes from being booked too early by a customer with low-value demand, e.g. a college student city trip versus an ad-hoc business trip.

2) The EMSRb

EMSRb is the abbreviation of Expected Marginal Seat Revenue and is a YM heuristic. It relies on frequent reoptimization when attached to real-time sources. Compared to its predecessor, EMSRa, it aggregates the demand and not the protection class previously calculated. Also, it weights the revenues by the revenue average and therefore approximates the optimal solution even closer. The protection limit for class i is denoted with y_i .

$$S_j = \sum_{k=1}^i D_k$$

After summing all known demands S_i , we start to weight the revenues R_i (revenue average).

$$R_i = \frac{\sum_{k=1}^i r_k \times D_k}{\sum_{k=1}^i D_k}$$

Then we apply Littlewood's rule [15].

$$P(S_i > y_k^{i+1}) = \frac{r_i + 1}{R_1}$$

We expect demand to be normally distributed.

$$y_i = \mu_i + z_\alpha \times \sigma_i$$

The parameter z_α is computed by the inverse of the Gaussian distribution and for every class i . This returns the protection limit for every class.

$$z_\alpha = \Phi^{-1}\left(1 - \frac{i + 1}{R_i}\right)$$

Caution. In this case we assume to know the demand of consumers. For this purpose historical data and probability could be consulted as pinpointed by McGill and Van Ryzin in Table II and Chapter 2 of reference [16]. It is static versus dynamic information, deterministic versus stochastic demand forecasting.

A. Combinations of Yield management

The breadth and combinations of YM goes beyond this short paper capability. But in general we identify six combinations as illustrated in Fig. 3 and mentioned throughout this document.

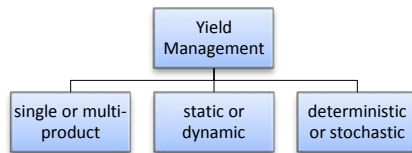


Fig. 3 - Combinations of Yield Management for IT-systems

B. Relations

YM is strongly related and even integrated with dynamic pricing in terms of instant adjustments to prices as soon new information is available.

Also, YM is assisted by promotion management, in order to sell the last capacity units in a period C_t . This is where protection of classes is abandoned and a price promotion is launched.

Dynamic packaging is basically the combination of several products selling as one. It requires matrix algebra in order compute dimensions and products for a single and optimal price.

IV. CONCLUSION

A. YM as a method to increase Economical Profit

YM is certainly a powerful approach to rapidly increase economical profit. Where applicable, it generates revenue increase from 3 to 7%, which might double profits in certain industries [17]. However, the development of YM-Systems is tedious and requires qualified and expensive human resources [18] in order to avoid unexpected consumer behavior in a market sensitive to any of the 5-Forces [19].

B. Question of Effectiveness – Price Discrimination

Demand-bound pricing have many hurdles and pitfalls, especially when based on many factors. Consumers are alienated and distracted by opaque pricing and price increase without any extra service [20]. Because consumers feel encouraged to choose another supplier, applies of YM try to hold up customer's retention and break the buyer-power with relationship marketing [21]. An unprofessional implementation of YM could go beyond the Nash Equilibrium [10] and do more damage than surplus.

C. Ethical and Economical Deficiency

Price discrimination and dynamic pricing is a delicate topic. YM delivers the foundation and many organizations tried to apply it. Coca Cola (CC) and Amazon (Amz) are global players, which experienced negative press [22] in the early years of this decade.

CC intended to dynamically adjust prices of refrigerated bottles depending on outdoor temperature. Consumer revolted harshly and denying these vending machines. Similar happened to Amz while in a test phase they bound prices to location and personal profiles. In this case, consumers simply logout or bought with other vendors. Amazon neglected the three major conditions, evidently the fact that DVDs are not perishable, and it is not a fixed and limited number of products as denoted in chapter III.A. The concept of YM is highly questionable, because it treats customers by the demand factor. It squeezes every consumer to the max and might also neglect status of socially deprived people.

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