

A Revenue Management method for the pricing and the assortment of bundles and ancillaries

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1 Introduction

In many businesses, selling non-core products is just as important as selling the main product, from a revenue point of view. These additional products have a minimal marginal cost, making them very cheap to produce. They are potentially seen as very relevant by some customers, considering that they could greatly improve the client experience. They are also important for the company, since they increase the overall profit. Moreover, these additional products have meaning only if bought with the main product, otherwise they are lost. For example, in the entertainment sector (i.e. movies, concerts, theaters) one can buy more comfortable places, which will be eventually lost if not sold before the event. In this context, it's very meaningful to make use of revenue management.

This is especially true for airlines, and as a consequence, the latest developments in the industry have the objective of pushing ancillaries purchase, even if they have been historically neglected [2]. In the airline context, we refer to these non-core products as ancillaries, which are products such as post-flight (i.e. car rental, hotel) or on-board (i.e. food, special seat) services.

Ancillaries can be combined together with a ticket into a single commodity called bundle. Therefore, the company will offer a bundle containing a set of ancillaries at a unique price. This strategy increases bundles demand and overall profit by giving up a part of the individual ancillary profit margin.

2 Challenge and Contribution

Web sales are particularly well adapted to offer bundles to customers, but the possible bundles combinations arising from the ancillaries are too many to be practically proposed on the website. Therefore, we need to find the most profitable subset of bundles to display. We have two main challenges: the pricing, thus finding the best price for each bundle and ancillary; and the assortment, hence finding the optimal bundles to offer, which are taken from a combinatorially large set. The pricing and the assortment are strongly connected between each others, since the prices depend on the assortment. Our objective is to find the best possible assortments, in the worst case we would need to solve a price optimization for each assortment. Furthermore, the diversity of the proposed bundles should be taken into account. We want to optimize the airline revenue, but we also want to propose to customers a set of diverse and relevant bundles.

A more subtle challenge is what we call the destroy ancillaries value effect. This negative outcome occurs when we don't consider that some ancillaries could be sold at a higher price after

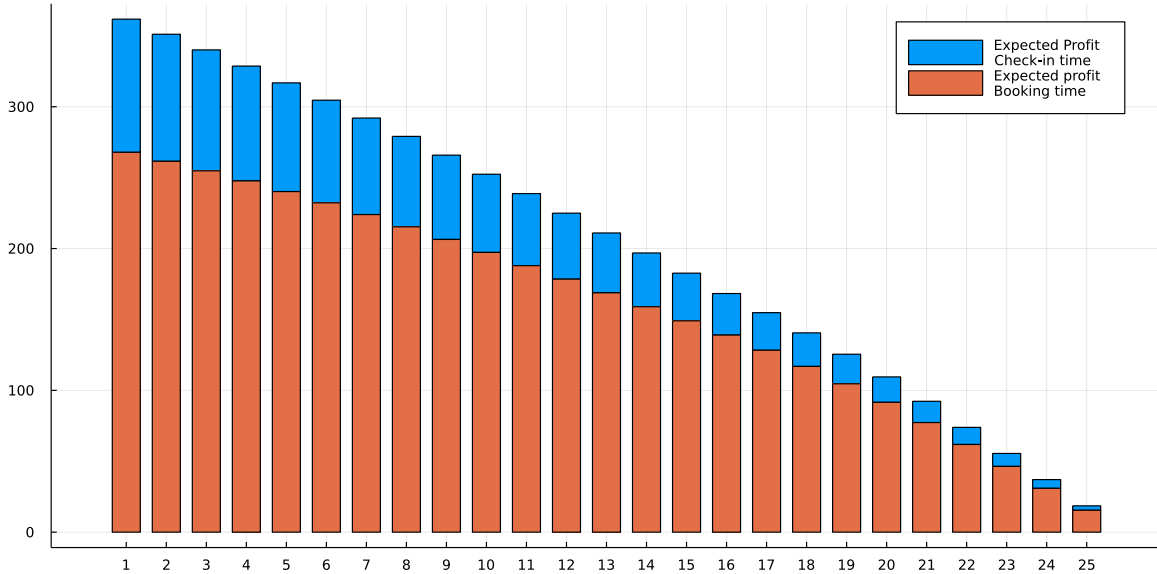


FIG. 1: Revenue distinction between booking and check-in time

the bundle has been bought. When we approach departure time, customers' price sensitivity decreases, in the sense that they are more inclined to spend more. Generally, it's because they have forgotten how much they have paid for the bundle or due to unexpected circumstances when they purchased the ticket.

In this work, we will present a revenue management model based on a Nested Multinomial Logit customer-choice model [1] that does not destroy ancillaries value. We will introduce a two stage booking process where we take into account two distinct times. In the first one, a customer can buy a bundle, and in the latter one, a customer can add some ancillaries that were not originally included. The expected revenue of the ancillary stage is taken into account in the bundle selling stage, to propose bundles that doesn't contain ancillaries that bring more revenue more later on. We divide our booking selling horizon in periods, in each one at maximum one customer can randomly arrive and decide to buy or not buy a bundle. It works similarly for ancillaries, but we consider only one period. Lastly, we will show how the assortment problem can be easily solved, without having to solve a pricing problem for each assortment.

As shown by Figure 1, preliminary results using synthetic data and carried out over a horizon of 25 periods, show a significant growth in revenue when using our model. Here, the orange section represents how much we gain by selling the bundle, and the blue one represents how much we gain by selling ancillaries at a later time. From the plot, we can see that offering ancillaries near the departure is crucial to increase revenue for the airline.

References

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