

A two stage model for the combined pricing and assortment of bundles offerings

Emanuele Concas¹, Axel Parmentier¹, Roberto Wolfler Calvo²

¹ CERMICS, Ecole des Ponts, Marne-la-Vallée, France
{emanuele.concas, axel.parmentier}@enpc.fr

² LIPN, Université Paris 13, CNRS UMR 7030, F-93430, Villetaneuse, France
wolfler@lipn.fr

Keywords : *dynamic pricing, bundles, airlines, revenue management, customer-choice model*

1 Introduction

In numerous sectors, the complementary products' sale is as important as the main product, from a revenue point-of-view. These products, seen as crucial by certain customers, improve considerably customer experience and company's profits. This holds true across various industries, from entertainment events to the dynamics of the airline industry.

In the airline industry, these products are also called ancillaries, and they range from non-core products, including post-flight services (e.g., car rental, hotel) and on-board services (e.g., food, special seats). They have been historically overlooked, but now airlines seek to use their potential to increase revenue.

2 Challenges and Contribution

While web sales offer an optimal platform for bundle offerings, the large number of possible combinations arising from ancillaries poses practical challenges. Our strategy involves bundling the ancillaries with a ticket to create a bundled proposition, with greater demand and overall profit, although at the expense of individual ancillary profit margins. Pricing and assortment decisions become intricately linked. The objective is to identify the most profitable assortments, which require a price optimization for each unique assortment. Balancing diversity in proposed bundles is equally critical to optimize airline revenue while providing customers with a varied and relevant selection.

A difficult challenge emerges in the form of the "destroy ancillaries value effect", where the potential for higher ancillary prices after a bundle purchase is often overlooked. This phenomenon arises as customers' price sensitivity diminishes near departure time, presenting an opportunity for increased spending. Hence, we introduce a revenue management model that addresses this effect, based on a Nested Multinomial Logit customer-choice model.

Our proposed model incorporates a two-stage booking process, considering distinct times for bundle purchase and ancillary addition. By factoring in the expected revenue of the ancillary stage during bundle selling, we aim to offer bundles without ancillaries that could potentially bring in more revenue later on. The booking horizon is divided into periods, each allowing for the arrival of a customer to decide on bundle purchase or ancillary addition.

Our results, derived from synthetic data over a 150-period horizon, demonstrate a significant revenue growth using our model. We compare our model with alternative approaches to demonstrate the shortcomings and weakness of each one. The findings highlight the critical importance of offering ancillaries near departure to maximize revenue for airlines.