Special Issue: Future of Airline Revenue Management

Emmanuel Carrier¹ · Thomas Fiig²

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This Special Issue focuses on the future of Airline Revenue Management (RM), but to anticipate the future, it is often useful to analyze the past so let us start with a brief summary of how airline RM has developed since its beginnings in the late sixties. Over the last five decades, revenue management has evolved mostly in a reactive mode to major changes that have affected the airline industry. Airline RM really took off in response to the economic deregulation of the U.S. airline industry in the late seventies. Faced with the emergence of aggressive lower-cost competitors such as People Express, American Airlines responded with the implementation of the first inventory control system as described by Smith et al. (1992) in their seminal paper Yield Management at American Airlines. In the 90s, airlines and RM vendors started to develop “origin–destination” RM systems in response to the restructuring of airline networks around large connecting hubs. In the 2000s, the airline RM community was caught off-guard when the relaxation of the Saturday-night stay requirement imposed on most discount fares in short-haul markets led to the collapse of existing RM systems whose forecasting methods relied on nicely segmented pricing structures. Most of that decade and beyond was spent first on understanding the issue (the now famous spiral-down effect) and

then looking for solutions such as the marginal revenue transformation proposed by Fiig et al. (2010)

Today, there are new transformative forces on the horizon that promise to have a major impact on airline markets such as the emergence of new distribution models that are often described under the banner of IATA NDC initiative and the impact of the digital and artificial intelligence revolution that airlines like other businesses are starting to leverage, in particular to gain more insight into individual customer behavior. This transformation is somewhat gradual and can be anticipated. This provides a unique opportunity for the airline RM and data science community to be proactive rather than reactive and start developing today the RM decision support systems, processes and best practices that will support these new distribution capabilities and competitive landscape. Thus, an issue on the future of airline revenue management is timely and the papers gathered here focus on the most relevant topics related to this upcoming transformation such as dynamic and personalized pricing and how to incorporate ancillaries into revenue management.

Given the relaxation of fare fences and the development of new techniques to address dependent demands across booking classes such as fare adjustment, Poelt, Rauch, and Isler emphasize the limitations of the current approach that use a single forecast for two tasks, calculating bid-prices and setting adjusted fares. They propose to split RM forecasting into two separate processes to develop a forecasting approach based on the type of data that is best adapted to each task. For calculating adjusted fares, they propose to focus on estimating the price–demand relationship irrespective of volume but to introduce new dimensions such as duration of stay that is correlated with price elasticity. For bid-price calculation, they propose a

✉ Emmanuel Carrier
emmanuel.carrier@delta.com

Thomas Fiig
thomas.fiig@sca.amadeus.com

¹ Operations Research & Data Science, Delta Air Lines, Atlanta, GA, USA

² Airline IT Research and Development, RMCC, Amadeus, Copenhagen, Denmark

more aggregated approach based on the contribution function rather than the demand for each product. This resolves many of the issues related to sparse booking data across a multitude of origin–destination markets and relies on historical bid-prices that are generally easily available rather than historical availabilities that are often incomplete at best and inaccurate at worst. This groundbreaking paper paves the way for the development of new pricing optimization techniques that will be key to leverage the capabilities of emerging distribution systems while also providing a new innovative methodology to calculate more reliable and stable bid-prices.

The next couple of papers focus on pricing optimization and use simulation techniques to explore the potential of new approaches. In their paper on Learning and Optimizing through Dynamic Pricing, Kumar, Li, and Wei study the benefit of deviating from the prices calculated using standard RM techniques to get a better estimate of passenger WTP and demand. They find that the value of introducing variability through price exploration is highest when the ratio of demand to capacity is in the medium range (approximately 80% load factor). This paper shows how traditional RM methods can be combined with emerging machine-learning techniques that are increasingly popular in other industries and suggests to focus the “exploration” budget on specific markets with relatively mild demand or time periods such as shoulder seasons or mid-week departure days rather than peak demand days.

In their paper, Wittman and Belobaba use the well-established Passenger Origin–Destination Simulator (PODS) to test the revenue performance of online algorithms that override the output of a standard RM system by exploiting additional information such as travel purpose that is readily available in PODS but can also be estimated in practice with a good level of accuracy based on characteristics of the booking request such as duration of stay or party size. They calculate increments for select business passengers or offer targeted discounts to leisure passengers based on an estimate of the willingness-to-pay distribution by passenger type. They find a potential revenue gain between 0.5 and 4% in a large competitive network with four carriers based on how many carriers implement personalized pricing. These results are promising as they propose to enhance the algorithm to take into account additional dimensions such as bid-prices, adjacent flights, or competitor prices.

The next couple of papers discuss how to extend existing RM systems to maximize revenues beyond the base ticket fare and incorporate the growing revenue streams

from ancillary products such as seat assignments and baggage fees. Vinod, Ratliff, and Jayaram provide a comprehensive overview of the different components of a future offer management system from the segmentation of the demand to how to assemble, price, and personalize bundles to better respond to the needs of each individual traveler. Bildea and Gorin go into more detail on how to develop a recommendation engine to offer ancillary services that are targeted to the needs of each market segment. They propose to adapt existing cross-selling algorithms they have been using successfully across a range of industries such as food service distribution. Applying this type of algorithms to the airline industry would allow carriers to provide more relevant offerings to their customers, and eventually integrate into general offer optimization solutions that leverage the future capabilities of NDC-type distribution systems.

But the benefits of new age NDC distribution will not fully materialize unless it also delivers value to consumers and builds upon RM legacy as a win–win scheme that benefits all actors in the travel distribution chain. Based on a survey of German consumers, Kramer, Friesen, and Shelton show that while dynamic pricing based on rules such as advance purchase and the strength of the demand relative to capacity has become somewhat accepted by a majority of travelers, most of them remain reluctant at this point toward personalized pricing that leverage their travel history to determine prices based on an estimate of their willingness to pay. As algorithms for personalized offers and pricing discussed in this Special Issue start to be implemented, airlines will have to craft smart strategies to gradually introduce them to the marketplace and ensure that they become if not enthusiastically embraced, at least perceived as fair and accepted by a broad range of customers.

From the sixties through the eighties, the airline industry was at the forefront of innovation: The airlines pioneered the distribution of tickets through a large-scale computerized network of travel agents and invented revenue management that was gradually adopted and adapted by many other industries. However, at the turn of the millennium, the airline industry lost its edge and we witnessed a new generation of Internet companies use the rapid improvement in computing power to develop a new class of machine-learning algorithms and provide a personalized experience to their large customer base.

As the breadth and quality of the papers gathered for this Special Issue demonstrate, the airline RM and data science community are actively engaged on leveraging the wealth of customer data at our disposal and developing new offer

management systems. But to unlock these benefits, the industry must remain focused on transforming its legacy distribution systems and making NDC-type distribution a reality. We will then be able to combine the treasure of our RM legacy with the emerging machine-learning techniques pioneered by others to deliver travelers the personalized experience that takes revenue optimization to the next level while improving customer satisfaction.

References

- Fiig, T., K. Isler, C. Hopperstad, and P.P. Belobaba. 2010. Optimization of Mixed Fare Structures: Theory and Applications. *Journal of Revenue and Pricing Management* 9 (1/2): 152–170.
- Smith, B.C., J.F. Leimkuhler, and R.M. Darrow. 1992. Yield Management at American Airlines. *Interfaces* 22 (1): 8–31.