Price Dispersion and Consumer Upgrade:  
Theory and Empirical Evidence from Airline Industry

The airline industry offers a canonical example of intertemporal price discrimination as an effective strategy for extracting heterogeneous customer valuations. Some customers, such as business travelers, book tickets closer to the travel date and are willing to accept higher fares. In contrast, others, such as leisure travelers, are more price-sensitive and book earlier. Airlines use revenue management methods to charge higher prices for the same seat when it is booked closer to the flight’s departure date. This strategy takes advantage of an important dimension of heterogeneity across customers – valuation for flexible scheduling, and leads to substantial dispersion of ticket prices in the main cabin of a particular flight instance.

Another important dimension of heterogeneity in the main cabin is customer valuation for comfort and convenience. While all customers prefer an enhanced experience of comfort and convenience on a flight, some customers are willing to pay more for these attributes. Recently, several airlines introduced a new seat type within the main cabin of the aircraft that is sold as an upgrade after the purchase of a main cabin ticket (e.g., United Airlines’ “Economy Plus” seating, Delta Airlines’ “Economy Comfort” seating, American Airlines’ “Main Cabin Extra” seating). These premium economy seats occupy the first few rows in the main cabin of the aircraft, and provide features such as greater legroom, extended recline, priority boarding, and complimentary beer and wine. While most customers pay the full price for the upgrade, elite members of frequent flier program often get discounts or are upgraded for free. In addition to allowing the airlines to boost the perks to their elite members, the premium seating upgrade allows the airlines to extract additional customer surplus that the intertemporal price discrimination lever was not effective at appropriating.
This paper provides insights regarding how a firm should adjust price discrimination strategies (i.e., revenue management strategies) for the base product when a new price discrimination lever, in the form of an add-on product, is introduced. As a relevant application, we study how the offering of premium seating upgrade in the main cabin changes the airline’s price dispersion, through both a theoretical analysis using a stylized model and an empirical analysis utilizing a proprietary transaction-level dataset from a major U.S. airline company.

Our stylized model captures two important considerations the airline faces in its pricing decisions when the upgrade option is offered. On the one hand, the airline benefits from lowering its main cabin prices after the introduction of the premium seating upgrade, because allowing more customers to the cabin gives the airline more opportunities to sell upgrades to premium seating (admission effect). On the other hand, customers’ value of flying with the airline may increase due to the availability of premium seats, therefore the airline may find it optimal to increase its main cabin prices (valuation effect). Our model indicates that the result of these competing effects after the introduction of premium seating upgrade is always associated with an increase in the dispersion of main cabin prices, however whether the prices of tickets bought by business (or leisure) travelers would increase or decrease depends on the relative strength of the admission and valuation effects for that customer segment.

In the second part of the paper, we offer empirical analyses based on a proprietary dataset of individual transactions from a major U.S. airline company spanning a time frame where the airline introduced the premium seating upgrade in domestic markets. The unique disaggregate feature of the dataset allows us to identify the price dispersion within a flight instance – a dimension of price variation that is driven by price discrimination based on customer heterogeneity, rather than by factors that may change over time and across flights, such as market conditions, congestion, and service costs. Our empirical analysis relies on a difference-in-differences strategy that takes
advantage of the panel nature of our data and identifies a quasi-experiment for identification. It compares the degree of price dispersion over different instances of the same flight in a “treated” market before and after the market experienced the introduction of the premium seating upgrade to the degree of price dispersion in flights in a similar “control” market that did not experience this upgrade introduction over the same time period.

In order to characterize price dispersion on a flight instance, we analyze several dispersion metrics considered in earlier research, including the Gini coefficient, the coefficient of variation, and the interquartile range. Our empirical results confirm our theoretical prediction that the price dispersion increases after premium seating introduction. Furthermore, in order to understand the mechanism behind this result, we also study how the 10th and 90th percentiles of the price distribution within a flight instance respond to the introduction of premium seating, respectively. We show that the 90th percentile of the price distribution (corresponding to the prices paid by business travelers) increased after the premium seating introduction, while the 10th percentile (corresponding to the prices paid by leisure travelers) decreased. Therefore, the empirical results indicate that the admission effect is to a large extent driving leisure prices down, and the valuation effect is to a large extent driving business prices up. The price decrease for leisure travelers may be driven by the airline’s incentive to allow more leisure travelers to purchase tickets because some customers may purchase upgrades to premium seats later and generate more revenue for the airline. Support for the impact of the admission effect on the low-end prices is further strengthened by an additional empirical finding: the increase in the price dispersion driven by a decline in the low-end prices is more pronounced in markets where the airline faces more competition. The price increase for business travelers may be driven by the fact that a lot of business travelers are typically elite members of the airline and are likely to automatically be upgraded to a premium seat, therefore their valuations may have increased.