The Welfare Implication of Overselling in the Airline Industry

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1. Motivation and Background

On April 9, 2017, the forceful removal of a doctor from a United Airline (UA) flight brought public attention to overselling, a practice that is legal, prevalent, but under noticed in the airline industry. According to the US Department of Transportation (DOT), in 2023 alone, 306,964 passengers were bumped from their air ticket voluntarily and 26,052 passengers were bumped against their will. While these numbers are tiny relative to the 865 million passengers that boarded any plane domestically last year, arguably many more passengers are subject to the risk of holding a valid ticket but unable to fly as planned. To be clear, one may expect the risk of being bumped above zero, for safety, weather or other reasons out of the control of airlines. But airlines can increase this risk by deliberately selling more tickets than the available seating capacity. From airlines' perspective, overselling can increase revenue and reduce the probability of flying with empty seats, as airlines often expect some ticket holders to miss the flight for idiosyncratic reasons. However, from consumers' perspective, overselling is a downgrade in the expected quality of airline service, as it increases the risk of being bumped if more travelers show up than anticipated and the cost of being bumped can be substantial.

To address the potential harm to bumped passengers, DOT mandates compensation for involuntary bumping and has raised the compensation amount twice in 2011 and 2021. Despite this requirement, there is an ongoing debate advocating for the outright prohibition of overselling to safeguard passenger interests. Arguably, a ban on overselling can improve the consumer surplus via the 'Quality Channel'. Overselling puts every ticket holder at risk of being bumped, causing potential distress even with monetary compensation. Banning overselling could eliminate this risk and associated disutility for passengers. However, such a ban might have unintended consequences through the 'Price Channel': a ban of overselling may lead to higher air fares for all passengers. Airlines, driven by the need to compensate for the lower extensive margin (number of tickets sold), might increase the intensive margin (price per ticket). The price-quality tradeoff is key to determine whether banning overselling would improve consumer and total welfare.

There is also disparity in terms of bumping risk and compensation regulation. First, people who buy tickets at more discount may face a higher bumping risk, because DOT lets airlines decide who to bump and allows airlines to deny boarding based on fare paid by passengers.[1] Though we do not know exactly how airlines determine bumping priority, there are economic incentives to bump those who pay less on a flight given that DOT-mandated compensation cost is proportional to the ticket price. This implies a disparity of bumping risk for economically-disadvantaged passengers. If residents in disadvantaged communities are more likely to buy air tickets at the lower-end of the price distribution within a flight, they may be subject to a higher risk of bumping. Second, airlines can avoid DOT compulsory compensation for involuntary bumping if they attribute bumping to safety or operational reasons on small aircrafts (60 or fewer seats). As a result, disadvantaged communities in non-metropolitan areas may be subject to a higher bumping risk and less bumping compensation because they have more exposure to small aircrafts. It would be interesting to examine if the pros and cons of overselling vary between disadvantaged communities and other markets.

[1] https://www.transportation.gov/individuals/aviation-consumer-protection/bumping-oversales. "…it is the airline's responsibility to determine its own fair boarding priorities. If there are not enough passengers who are willing to give up their seats voluntarily, an airline may deny you a seat on an aircraft based on criteria that it establishes, such as the passenger's check-in time, the fare paid by the passenger, or the passenger's frequent flyer status."

2. Research Question and Expected Contribution

The ultimate goal of this project is to quantify the welfare implications of overselling in the US airline industry and describe the distribution of such welfare implications across different types of passengers (low-pay and high-pay) and different types of markets (disadvantaged communities versus other markets). As shown below, we have already gathered some reduced-form evidence around the 2017 UA incidence. We are in the process of constructing and estimating a flexible structural model to study the demand and supply of overselling. The structural estimates will enable us to compare a number of counterfactual policies, ranging from an outright ban of overselling to raising the compensation for bumped passengers, educating the public on overselling and compensation entitlements, and tailoring different DOT regulations for different communities.

Our study contributes to ongoing policy debates and several strands of literature. On the policy side, many policy makers have publicly expressed their intolerance toward overselling. Former New Jersey Governor Chris Christie called for a total ban on overselling following the incident in 2017.[2] One Senate bill was introduced to ban involuntary bumping in 2017[3] and another Senate bill was introduced in 2023 to raise compensation for denied boarding due to overselling.[4] On the literature side, we contribute to several relevant topics including price/non-price discrimination in the airline industry (Aryal et al., 2024; Williams, 2022; Agbo et al., 2014; Lazarev, 2013), trade-off between price and quality competition (Dranove and Satterthwaite, 1992; Milyo and Waldfogel, 1999), and asymmetric information and consumer protection (Brown et al., 2010; Blake et al., 2021).

3. Data

The primary data for this study is sourced from the DOT and FAA (Federal Aviation Administration). DOT public data provides information on 10% domestic trips' ticket price and sales (DB1B), seating capacity and enplanement (T-100), as well as bumping rates and compensation costs for each carrier. FAA's ADIP data provides the geographical information of disadvantaged communities and airports. While the public data are expansive, we cannot calculate the degree of overselling and bumping rate by carrier-route-time because different datasets are reported at different levels: for example, bumping and compensation are reported by carrier-quarter (no route information), the DB1B data is reported by carrier-route-quarter, flight capacity and enplanement are reported by carrier-route-month, but ticketing and enplanement data may not match each other because some tickets have connections and international travelers' domestic trips in the US are included in enplanement but excluded from domestic ticketing. More granular information on bumping, flight capacity and boarding would be extremely valuable to our research.

4. Method

Reduced-form Evidence. The violent bumping incident on April 9, 2017 generated a public relation crisis for UA. In response, UA pledged to reduce overselling and enhance compensation in April 2017. Taking this incident as an exogenous shock to UA's overselling practice, we explored the effect of overselling on price.

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[2] https://www.politico.com/states/new-york/city-hall/story/2017/04/christie-calls-united-incident-abusive-and-outrageous-urges-ban-on-airline-overbookings-111188

[3] https://www.washingtonpost.com/news/dr-gridlock/wp/2017/04/26/senate-bill-would-expand-protections-for-air-travelers-require-study-of-airline-overbooking/

[4] https://www.npr.org/2023/02/07/1154974524/an-airline-passengers-bill-of-rights-seeks-to-make-flying-feel-more-humane

Figure 1 shows that UA's bumping rate dropped faster than other legacy carriers after the incident. To quantify its effect on price, we take the 2017 UA incident as a treatment to UA's overselling behavior and conduct a Difference-in-Differences (DID) analysis for different percentiles of price, while taking other legacy carriers (American, Delta and Alaska) as the control group. All regressions control for carrier-route fixed effects and quarter fixed effects.

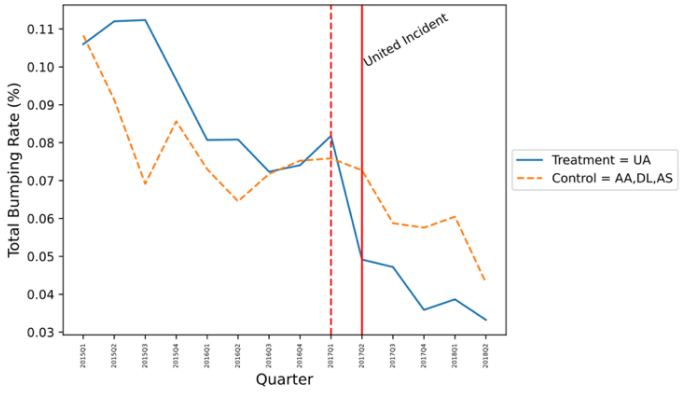


Figure 1: Bumping Rate (UA-United, AA-American, DL-Delta, AS-Alaska)

Results in Table 1 Panel A show that UA increased its price after 2017Q1 relative to other legacy carriers, and this increase was greater at the lower-end (5.2-5.9% for the 5th percentile, median and 10th percentile of price) than at the higher-end (4.0-4.1% at 90th and 95th percentiles).

Table 1 panel B repeats the DID exercise for EAS markets, where we define a route as an EAS market if either its origin or destination is on DOT's Essential Air Service (EAS) program (Drukker, 2023). EAS airports can be viewed as a subset of airports serving disadvantaged communities because they are all located in relatively remote less-developed areas where transportation infrastructure is insufficiently provided. Unlike regular markets, we do not find the 2017 UA incident to have any significant effect on ticket price sold in the EAS markets. This is not surprising because EAS markets only account for around 0.1% of UA's ticketing revenue. Moreover, because EAS markets are more likely to use small aircrafts and involuntary bumping in the small aircraft case can be excused by safety reasons, we expect UA's overselling behavior to stay stable in EAS markets and thus there may not be a differential price hike post 2017Q1.

However, if we look at the raw data cross-sectionally, airlines with a higher revenue share from EAS markets tend to have a higher involuntary bumping rate and a lower average compensation for involuntary bumping. This is largely driven by Spirit Airlines. Spirit and Allegiant Air, two well-known super low-cost airlines, carry over 65% of EAS passengers. Spirit's involuntary bumping rate is the highest of all five airlines serving EAS, but its average compensation for involuntary bumping is almost the lowest of all. In contrast, Allegiant Air has the highest share of revenue devoted to EAS markets and the lowest average compensation for involuntary bumping rate, although its bumping rate is relatively low. These patterns suggest that disadvantaged markets such as EAS could be vulnerable to high bumping risk, low bumping compensation, or both, potentially as a result of overselling.

Panel A	All Markets				
	y=p5 log(p)	y=p10 log(p)	y=p50 log(p)	y=p90 log(p)	y=p95 log(p)
UA*Post	0.052***	0.059***	0.056***	0.040***	0.041***
	(0.015)	(0.015)	(0.012)	(0.010)	(0.010)
Route-Carrier FE	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y
Obs.	10707	10707	10707	10707	10707
R2	0.837	0.846	0.854	0.847	0.827
Panel B	EAS Markets				
	y=p5 log(p)	y=p10 log(p)	y=p50 log(p)	y=p90 log(p)	y=p95 log(p)
UA*Post	0.051	-0.020	-0.031	-0.022	0.024
	(0.097)	(0.094)	(0.052)	(0.041)	(0.054)
Route-Carrier FE	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y
Obs.	1011	1011	1011	1011	1011
R2	0.848	0.855	0.862	0.763	0.645

Note: Standard errors are clusterd at the route-carrier level.

Table 1: Effect of the 2017 UA Incident on UA's Price

Structural Model. To run counterfactuals of alternative policies, we first need to recover the demand curve faced by carriers. Our modeling of consumer's carrier choice problem will extend the traditional discrete-choice model by introducing consumer's belief of bumping probability and the expected disutility of getting bumped. The disutility from bumping in our model can vary among consumers from different markets. For example, bumping may lead to bigger inconvenience for travelers from disadvantaged communities due to tighter budget constraints or less transportation alternatives. On the supply side, carriers can oversell but must contend with uncertainty regarding show-up rates and consequential compensation costs. Carriers can conduct price discrimination by setting two price levels, one for those with high willingness to pay and another for those with low willingness to pay. Optimal price decisions will strike a balance between maximizing profits through increased sales and mitigating the costs of compensating unexpected passengers. The potential negative impact of overselling also extends to consumers' perceptions of carriers' bumping rates. If aggressive overselling creates a negative impression, risk-averse consumers may be deterred, which reduces the demand for the carrier. More importantly, our model allows carriers to respond to the heterogeneity in DOT's compensation policy, for example, by aircraft size in disadvantaged or other markets. If overselling is less costly in a market, the carrier has more incentives to oversell more seats at a lower price. The structural model will be estimated by Generalized Method of Moments (GMM), by matching the observed and simulated moments on bumping rate, price distribution, tickets sold, and load factor.

We plan to conduct four sets of counterfactual policies. First, since altering the standard of bumping compensation is the only tool that has been used by DOT so far, it is natural to ask if raising or lowering the current standard can deliver extra welfare gains. Second, lots of consumers are unaware of the risk of getting bumped and of the right to claim compensation upon being bumped, especially before the UA incident. If we raise the public awareness of overselling and compensation rights entitled by DOT, airlines may care more about their overselling reputation and be more conservative about overselling. Thus, our second set of counterfactuals will be adjusting consumer's belief of bumping risk. Third, an outright ban on overselling has been proposed for many years. We will resolve the equilibrium by restricting airlines from overselling. Fourth, since demand conditions vary a lot between disadvantaged communities and other markets, a uniform policy might not fit all markets. Therefore, it would be interesting to investigate if it is better-off to design an overselling regulation policy contingent on market type or consumer type.

Summary Statement: To our best knowledge, the proposed project is the first economic study that builds up a full structural model to investigate the pros and cons of overselling. The potential findings from our study will quantify the welfare implication of overselling in the U.S. airline industry. The structural estimation will enable us to compare consumer and total welfare under current DOT policy on bumping compensation versus alternative policies that are brought up in public debates and U.S. Senate. Our framework will also account for the heterogeneity between disadvantaged communities and other markets, and explores the possibility to tailor DOT policies in order to better serve different communities.

Conflict of Interest Statement: The whole research team of this proposal doesn't have any financial or other interests bearing on the proposed work. None of us has any financial or other ties to the airline industry.

Reference:

Agbo, M., Santugini, M., and Williams, J. W. (2014). Screening with congestion.

Aryal, G., Murry, C., and Williams, J. W. (2024). Price discrimination in international airline markets. Review of Economic Studies, 91(2):641–689.

Blake, T., Moshary, S., Sweeney, K., and Tadelis, S. (2021). Price salience and product choice. Marketing Science, 40(4):619–636.

Brown, J., Hossain, T., and Morgan, J. (2010). Shrouded attributes and information suppression: Evidence from the field. The Quarterly Journal of Economics, 125(2):859–876.

Dranove, D. and Satterthwaite, M. A. (1992). Monopolistic competition when price and quality are imperfectly observable. The RAND Journal of Economics, pages 518–534.

Drukker, Austin (2023). How Essential Is Essential Air Service? The Value of Airport Access for Remote Communities. US Department of Transportation, available at https://rosap.ntl.bts.gov/view/dot/68535.

Lazarev, J. (2013). The welfare effects of intertemporal price discrimination: an empirical analysis of airline pricing in us monopoly markets. New York University.

Milyo, J. and Waldfogel, J. (1999). The effect of price advertising on prices: Evidence in the wake of 44 liquormart. American Economic Review, 89(5):1081–1096.

Williams, K. R. (2022). The welfare effects of dynamic pricing: Evidence from airline markets. Econometrica, 90(2):831–858.