A Simulation Approach to Understanding the Competitive Effects of the Spirit-JetBlue Merger

by

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Dissertation submitted in part-fulfilment of the MSc in Economics,

University College London

September 2024

Declaration

I, Srishti Aggarwal, hereby declare that the work presented in this dissertation is my own original work. Where information has been derived from other sources, I confirm that this has been clearly and fully identified and acknowledged. No part of this dissertation contains material previously submitted to the examiners of this or any other university, or any material previously submitted for any other assessment.

Name: Srishti Aggarwal
Date: 18th September 2024

Classification

This piece of research is primarily an empirical/econometric study.

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Word count: 9950

ACKNOWLEDGEMENTS

I would like to extend a heartfelt gratitude to my family and friends for their immense support throughout the dissertation phase and the MSc Economics journey.

I would also like to express my gratitude to Professor Valérie Lechene for her insightful sessions on the various aspects of writing a thesis. They were instrumental in shaping my approach to this research. Her dedication to teaching and her support were crucial in preparing me to undertake this project effectively.

Lastly, the invaluable advice of Professor Joao Granja has been immensely helpful. His guidance and advice granted me the freedom to explore and conduct research while also providing clear direction, which I am extremely grateful for.

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ABSTRACT

This paper seeks to examine the competitive implications of the proposed JetBlue-Spirit merger, which was blocked by regulatory authorities in January 2024. The decision was based on concerns that the creation of the fifth largest domestic airline would diminish competition by limiting consumer choices, especially for price-sensitive travelers, and potentially increase fares, especially in markets where both airlines have major presence. This study employs a standard merger simulation methodology to forecast post-merger prices and assess other competitive impacts as outlined in the Horizontal Merger Guidelines issued by the U.S. Department of Justice and the Federal Trade Commission. The merger simulation is conducted by integrating a two-level nested logit demand model with an oligopoly supply framework. The findings suggest that prices would rise in both overlapping and non-overlapping markets, with passenger-weighted fare increases of 2.14% and 1.05% respectively. Markets such as Orlando-Richmond and Miami-Richmond, where JetBlue and Spirit dominate the non-stop service, are projected to experience the most significant impact. Consumer welfare is expected to fall on average by 0.17% and 0.09% in overlapping and non-overlapping markets. Other metrics such as HHI and analysis of unilateral effects further reinforce concerns about the merger's potential anti-competitive impacts. The predictions outlined in the study provide a counterfactual framework as they cannot be empirically tested due to the merger being blocked. The paper discusses potential model enhancements and data requirements to improve the accuracy of the model. (*JEL* L13, L25, L93)

1 INTRODUCTION

JetBlue reached an agreement to acquire Spirit airlines on July 28, 2022, following an extended bidding war with Frontier airlines. The agreement was valued at approximately $3.8 billion[1]. It was a significant development in the airline industry, as the merger would have created the fifth-largest domestic airline in the United States. This would challenge the dominance of American, Delta, United, and Southwest, by intensifying competition in the market. The merger came a decade after the last major airline consolidation, the 2013 merger between American Airlines and US Airways.

JetBlue claimed that the merger would generate $600-700 million in annual synergies and accelerate its expansion by operating over 1,700 daily flights to more than 125 destinations[2]. It aimed at expanding its low-cost carrier network, particularly in key markets like Florida and the Northeast. The claims stated that the combined entity would offer lower fares along with JetBlue's customer service standards, enhancing its ability to compete in an increasingly consolidated airline industry[3].

In March 2023, the U.S. Department of Justice and several states filed a lawsuit against the merger under Section 7 of the Clayton Act[4]. The argument followed that the acquisition would reduce competition and lead to as high as 30% increase in prices for consumers, especially on routes where both airlines already have a strong presence. This resulted in a U.S. District Court judge blocking the merger in January 2024[5]. JetBlue and Spirit appealed the decision, but eventually mutually agreed to terminate the

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[1] Source URL: https://www.justice.gov/opa/pr/justice-department-statements-jetblue-terminating-acquisition-spirit-airlines
[2] Source URL: https://ir.jetblue.com/news/news-details/2022/JetBlue-and-Spirit-to-Create-a-National-Low-Fare-Challenger-to-the-Dominant-Big-Four-Airlines-07-28-2022/default.aspx
[3] Source URL: https://www.theguardian.com/business/2024/jan/16/judge-blocks-jetblue-spirit-airlines-acquisition
[4] It prohibits mergers and acquisitions where the effect "may be substantially to lessen competition, or to tend to create a monopoly." Source URL: https://www.ftc.gov/advice-guidance/competition-guidance/guide-antitrust-laws/antitrust-laws
[5] Source URL: https://skift.com/2023/08/16/jetblue-spirit-airlines-deal-a-skift-timeline/

merger in March 2024 due to challenges in meeting the conditions required for the deal by the July 2024 deadline[6].

Since Spirit and JetBlue operate in the same industry, the merger is classified as a Horizontal merger. FTC will therefore review it following the Horizontal merger guidelines (HMG)[7]. The guidelines focus on the methodology and effects that FTC focuses on when evaluating the competitiveness of horizontal mergers. The proposed merger underwent scrutiny as it would have led to the formation of fifth largest domestic airline. Secondly, it would have led to the elimination of Spirit's ultra-low-cost model, thereby adversely impacting customers through higher prices and fewer options, especially the cost-conscious travelers. Lastly, the merger would establish a low-cost carrier (LCC) that would compete directly with SouthWest, which is currently a market leader in the LCC space.

The primary focus of the study is to assess the competitive effects of the proposed Spirit-JetBlue merger and its consequences for travelers by examining certain elements detailed in HMG. It seeks to add to the literature on mergers in U.S. airline industry with the most recent available data by conducting a merger simulation. The study then leverages the the predictions of the model to assess some important concerns put forward by authorities that led to the merger being blocked.

The methodology followed in this paper is in line with *Peters (2006)* study. It comprises of demand estimation using pre-merger data, inference of marginal costs by assuming partial coordination between airlines, and prediction of change in prices post the merger under certain assumptions. The study focuses on two subsets of data: overlapping markets where both Spirit and JetBlue operate, and non-overlapping markets where only either of the airline operates. Overlapping markets are affected on account of reduced competition, economies of scale and capacity adjustments. Non-

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[6] Source URL: https://news.jetblue.com/latest-news/press-release-details/2024/JetBlue-Announces-Termination-of-Merger-Agreement-with-Spirit/default.aspx
[7] Source URL: https://www.justice.gov/atr/horizontal-merger-guidelines-0#22

overlapping markets are impacted by expansion of service using combined network and cost efficiencies.

The remainder of the paper is organized as follows: Section 2 involves reviewing of the literature on demand estimation and merger simulation. Section 3 talks about the methodology used to estimate demand and conduct the simulation. Section 4 details the data sources, criterion of data selection and the variables and instruments included in the study. Section 5 reports the main results from the estimation and simulation. Section 6 discusses the limitations of the study and scope for further research. Section 7 briefly concludes.

2 LITERATURE REVIEW

This section talks about the existing relevant literature on demand estimation and merger simulation using key papers on theoretical and empirical economics and industrial organization literature. These papers revolve mainly around applying structural econometric models to simulate mergers and assess the impacts on prices, market power, and consumer welfare. The primary focus will be on the literature that is relevant for the airline industry.

2.1 DEMAND ESTIMATION

2.1.1 Classic and seminal works

Berry, Steven T. (1994) introduces a methodology to estimate demand in markets with differentiated products. Berry's model uses the random utility framework to derive a discrete choice model, which is then applied to an oligopolistic market setting. The random utility approach allows for product differentiation by incorporating the randomness of consumer choices, which is crucial in markets like airlines where consumers face many different options (e.g., different carriers, schedules). By capturing both observable and unobservable factors influencing consumer decisions, the random utility model provides a flexible and realistic framework for estimating demand. It also addresses the endogeneity of prices, a key issue in demand estimation, and deals with it using instruments, making it possible to generate more accurate estimates of how prices affect demand in the presence of unobserved factors. The approach helps to infer demand using aggregate market data instead of detailed micro-level data, making it useful for a wider range of empirical studies.

Berry, Levinsohn, and Pakes (1995) (BLP) build on Berry’s (1994) discrete choice model by introducing random coefficients that enable flexible substitution patterns across products with a focus on automobile industry. The endogeneity problem is explicitly dealt with here. The instruments used are based on exogenous cost shifters, the characteristics of other products produced by competing firms, and characteristics of other products by same firm. After using instruments, BLP found that the estimated price elasticities were typically more negative, meaning consumers are more price sensitive than previously thought without the instruments.

Nevo, Aviv (2000) work is essentially an extension and application of the BLP approach, adapted to the specific characteristics of the ready-to-eat cereal industry. Nevo also employs the instrumental variable strategy, recognizing prices may be correlated with unobserved factors, such as marketing efforts or unmeasured product attributes. He finds that cost - based instruments are effective in addressing the endogeneity problem. Nevo emphasizes that week estimates can lead to biased or imprecise estimates.

2.1.2 Airline industry-specific

Proussaloglou, K., & Koppelman, F. S. (1999) analyze the multi-level decision making process of flyers using a nested logit model with data from Chicago and Dallas. The model is constructed to represent the hierarchy of choices passengers face: first selecting an airline, then a flight, and ultimately fare class, allowing the model to consider the correlation of unobserved factors within each level of choice. The study estimates price elasticity of air travel demand, revealing that passengers are sensitive to fare changes. Business travelers are significantly less price-sensitive than leisure travelers, with the former having a coefficient of -1.56 compared to -4.67 for the latter. The findings also highlight the importance of non-price factors like frequency and on-time performance in influencing passenger choice.

Brueckner, Dyer and Spiller (1992) examine pricing strategies of airlines operating in hub-and-spoke networks in the U.S. domestic market using a theoretical framework and find that existence of such networks reduce costs. *Berry, Carnall and Spiller (1996)* analyze the economic dynamics of airline hubs with a focus on cost structures, pricing strategies and the role of consumer heterogeneity in the airline industry using a mixed logit model for different consumer types. The findings reiterate that existence of economies of density lead to cost savings and suggest that carriers at their hubs can take advantage of their dominant position to charge a premium, especially from the business travelers which are more price-insensitive than their counterparts. The incorporation of consumer heterogeneity results in more accurate demand curves and pricing strategies for airlines.

Berry and Jia (2010) studied the supply and demand in US airline industry post major landscape changes (bankruptcies, mergers) in the industry leading to large reduction in profits for legacy carriers, despite fuller flights and more people travelling. They used a multinomial logit model for demand estimation, allowing to better capture consumer preferences for different carriers and routes and leverage instruments to address the endogenous prices. They introduce distance squared variable in the model to capture the demand curvature. The study's findings contribute 80% of the profit reduction to increase in price sensitivity, stronger preference and marginal cost favorability for direct flights, and expansion of low-cost carriers (LCCs). Air travel demand is found to be 8 percent more sensitive in 2006 compared to 1999, with price coefficients going up for both business travelers and tourists. LCC entry was found to have significantly higher impact on direct than connecting flights.

2.2 MERGER SIMULATION

Kim and Singal (1993) examine 14 U.S. mergers during 1985-1988 to study the associated tradeoff between market power and efficiency gains during a time when mergers were uncontested. A difference-in-differences approach is used to compare price changes on merger-affected routes with those on unaffected routes. They find that affected routes reflect significantly higher price increases than the control group, implying that there is an increased market power effect that dominates any efficiency gains. This is more pronounced for longer routes where substitution with other modes of transport is harder. They observe that in the case of mergers where the firm being acquired is in financial distress, fares are below industry level until merger completion, with even a further reduction. Post completion, there is a drastic rise in prices, but with prices remaining below industry level. This pattern is closely followed by rival firms, likely owing to the greater collusion between remaining carriers.

Werden and Froeb (1996) advocated for use of simulation as a more precise and flexible alternative to structural merger policy, especially in industries where products are differentiated, not homogeneous. They showcase the use of logit demand model to estimate how sensitive customers are to changes in prices. They note that while simulations are a good quantitative starting point for analysis, there are challenges with the technique that primarily involve detailed data, and the assumptions made related to consumer preferences and competitive dynamics. So, information and insights from other sources should be supplemented to get precise results.

Peters (2006) determines the accuracy of merger simulation methods by comparing the predicted post-merger and actual post-merger prices for five U.S. airlines. He uses a discrete-choice demand model with generalized extreme value (GEV) specification and with the estimated parameters imputes marginal costs, assuming a static Bertrand conduct wherein firms choose prices noncooperatively. He concludes that while the effect of change in ownership on unilateral pricing strategies could be accounted for decently well, there was a need to incorporate more flexible models of firm conduct to improve the predictive power of simulations.

Lee (2013) examined the predictive power of merger simulations by endogenizing both prices and product characteristics, a change to overcome the limitations of standard simulations which assume latter to be identical pre- and post- merger. The study analyzes the 2008 merger of two airlines that had an overlap of more than 450 markets, Delta and Northwest. Lee finds that firms practice higher product differentiation post-merger, which also affects the merged firm's incentive to increase prices. The findings also suggest that producer surplus as well as consumer surplus increase overall, with business passengers benefiting a great deal while tourists experiencing small losses.

Björnerstedt and Verboven (2016) analyze a merger in Swedish analgesics market using merger simulation. They employ a two-level nested logit demand model with firms engaging in Bertrand competition within an oligopolistic framework. The merger simulation predicted a 34% price increase for the merging firms, closely matching the actual increase of 35% relative to non-merging competitors.

Ciliberto and Williams (2014) demonstrate that multimarket contact facilitates coordination between firms without explicit agreement, i.e., tacit collusion. They construct a flexible model of oligopolistic behaviour for U.S. airline industry and the conduct parameters are modelled as functions of multimarket contact. They find that increased contact across multiple markets leads to less competitive behavior to avoid retaliation. Legacy carriers often cooperate on pricing, while cooperation between legacy and low-cost carriers is minimum. American's conduct parameters with Delta and JetBlue in Q1 of 2007 are found to be 0.856 with an overlap of 855 markets and 0.064 with 84 overlapping markets respectively. Their results suggest that mergers between legacy carriers don't necessarily result in higher prices because of potential cost synergies and little consequence for market power.

Benkard et al. (2010) estimate policy functions using historical pre-merger data and simulate future industry outcome with and without merger. They focus on importance of dynamic effects in merger evaluations using 3 proposed U.S. airline mergers. The findings indicate that when two major hub carriers consolidate, it increases entry by other hub carriers and by low-cost carriers. This helps in reduction of initial market concentration caused by the merger.

3 METHODOLOGY

Merger simulation predicts the post-merger fares with the help of information about pre-merger market conditions and several assumptions regarding the conduct of the carriers operating in the relevant market. Firstly, it requires estimation of a demand model which specifies the relationship between prices and quantities in the relevant market. Post that, marginal costs are recovered by making assumptions about the nature of interaction between airlines. The last step involves imputing post-merger prices under specific assumptions regarding changes in firm conduct and cost because of the merger. This section describes each step and its specificities in greater detail.

3.1 DEMAND ESTIMATION

The demand models for differentiated products can typically be divided into two main categories: functional-form models, that are based on a predetermined parametric relationship between quantities and prices (e.g., Almost Ideal Demand System (AIDS) and constant-elasticity models), and discrete-choice models, that derive demand from an explicit utility function which models individual choices from a set of alternatives based on their characteristics (e.g., logit, nested logit, and random-coefficients models like BLP). *Peters (2006)* discusses how functional-form models struggle with product-level demand estimation in the airline industry due to limitations like quarterly data and differing product sets across markets. In contrast, discrete-choice models offer flexibility by modeling demand based on product characteristics, without requiring individual products to appear repeatedly in the data. Consequently, discrete-choice models are used in this study as they are better suited for estimating airline demand.

Within the discrete choice models, nested logit with two levels is utilized for the study, owing to the relevant literature in the field and the computational requirements. Nested logit relaxes the IIA assumption[8] by grouping

[8] Independence of Irrelevant alternatives (IIA) states that the odds of choosing between two alternatives is not impacted by the presence or characteristics of a third alternative.

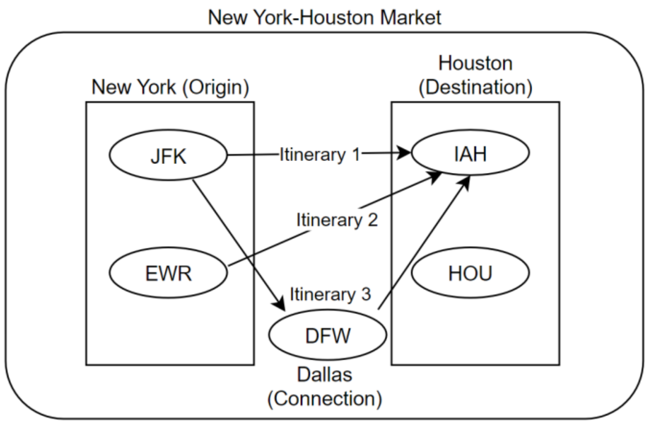
products into different nests, each governed by a logit model. This allows for substitution patterns to differ between and within the nests. This is appropriate because flyers are likely to substitute between airline products based on characteristics like connections and departure times. The appropriate nest selection is crucial because the IIA assumption still applies within each nest. The multinomial logit model (MNL) is not ideal because it doesn't possess the desirable properties stated above.

3.1.1 Demand model

The demand model is set in line with Peters (2006) methodology. A market is defined as an ordered origin destination city pair, where a city is a Metropolitan Statistical area (MSA)[9] delineated by U.S. Office of Management and Budget (OMB). The ordering of the cities is consequential because San Fransico-Texas is a different market than Texas-San Fransico. This way of defining market allows for the possibility of a city having multiple airports and for the consumers to substitute between those airports conveniently. Further, a product is defined as an airline-itinerary combination, where an itinerary is the ordered sequence of airports that a flyer passes through in a journey. Texas-SF-Orlando and Texas-Orlando are two different itineraries and hence products, but essentially the same market because first origin and last destination are the same, which is how we have defined a market.

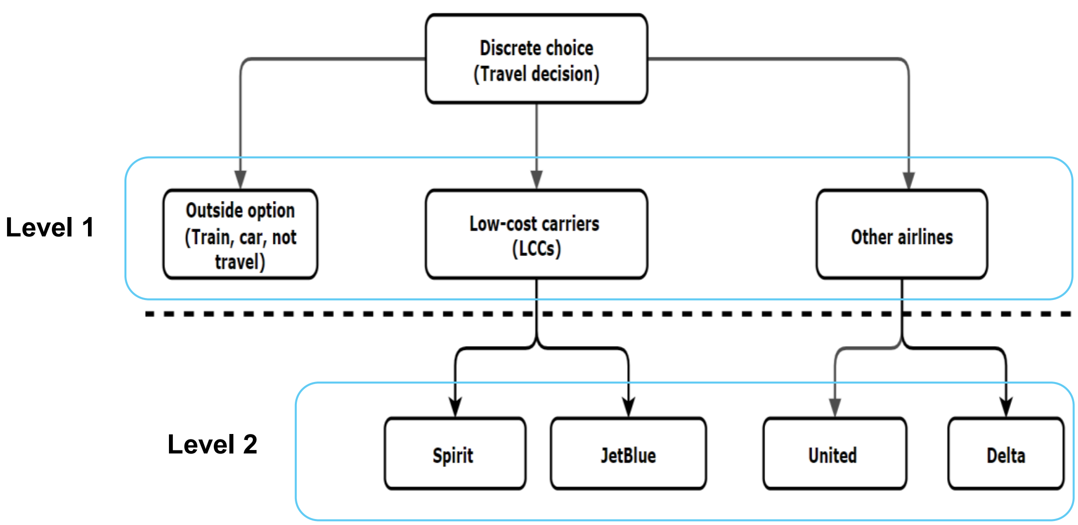
[9] MSA represents an area with a high population density at its core and close economic and social ties to surrounding communities.

Figure 1: Illustration of itinerary and market



For demand estimation, a two-level nested logit model is selected because it considers that products within a group or subgroup are closer substitutes and hence allows consumers to have correlated preferences within the same category. The model is a part of McFadden's (1973) GEV discrete choice model.

Figure 2: Illustration of two-level nested logit



In the outer nest, consumer decides between Low-cost carrier (LCC), other type of airline, or the outside option which includes other modes of transport or not travelling at all. There is probably a high correlation between flyer preferences for those who opt for LCCs compared to other airlines. Firstly, this is on account of significant differences in terms of fares *(Abda, et al., 2012)*, service quality and on-time performance *(Atalık & Özel, 2007)*, safety perception (*Cunningham, et al., 2004*) and airport locations *(Graham, 2013)*. Secondly, it is driven by differences in willingness to pay, purpose of travel, and socioeconomic factors (*Drabas and lung Wu, 2013; Davison and Ryley, 2010; Wen and Lai, 2010*). Each outer nest contains a lower nest wherein the passengers choose a product from a particular airline for their journey. This essentially forms the basis of the two-level nested logit model.

3.1.2 Random utility maximization

The starting point is a model wherein consumers choose the alternative that maximizes individual random utility. The choice of all consumers is then aggregated and inverted to calculate overall market shares which can then be estimated using real world data. This aspect of the methodology is consistent with the approach of *Björnerstedt and Verboven (2016).*

Each consumer i derives utility from price, observed product characteristics, and unobserved characteristics. Consumer i chooses one product j from $J+1$ products wherein $j=0$ stands for the outside option, which in this case is choosing some other mode of transport or not travelling.

The indirect utility of passenger i from choosing product j is given by:

$$u_{ij} = \beta x_j - \alpha p_j + \xi_j + v_{ij} \tag{1}$$

where,

- p_j is the price of product j
- x_j is the vector of product characteristics that are observed
- ξ_j is the vector of product characteristics that are unobserved (to the econometrician)

- v_{ij} is the unobserved random utility term that follows GEV[10] distribution

Since it is a two-level nested logit, j products are segregated into $K + 1$ nests (subgroups) denoted as $D_0, \dots, D_k$. D_0 only has the outside option. Each product is a part of a unique nest. For products within the same nests, the random utility term is correlated. However, for products belonging to separate nests, v_{ij} is assumed to be uncorrelated. λ_k measures the degree of independence of v_{ij} within a nest. When $\lambda_k = 1$, the nested logit model behaves like a multinomial logit model, implying that the alternatives within a nest have no correlation and are independent of each other.

The model adopts the Unit demand specification (UDS). This is more suitable for airline industry than constant expenditures specification because of the indivisible nature of airline tickets and the binary nature of the decision to travel. Consumers generally adjust their plans to travel according to fluctuations in prices and don't generally fix a budget for travel, at least in the short run. Many studies including *Aguirregabiria and Ho (2009)* and *Berry and Jia (2010)* leverage UDS to estimate demand for airline travel.

UDS specification also allows consumers to purchase multiple units of one product that they choose at a given point in time. It is helpful in travel industry because people often purchase multiple tickets for a single itinerary when traveling with family and friends.

Each flyer chooses a product j to maximize their random utility, u_{ij}. Considering UDS, equation (1) becomes:

$$u_{ij} = \delta_j + v_{ij} \tag{2}$$

where,

- δ_j represents the mean component of utility, expressed as:

[10] Generalized Extreme Value (GEV) distribution allows for correlation within groups along with maintaining IIA property across different nests.

$$\delta_j = \beta x_j - \alpha p_j + \xi_j \tag{3}$$

Here, δ_0, the utility of the outside option is normalized to zero to simplify the estimation process and to provide a clear reference point to interpret results.

- $-\alpha p_j$ denotes the disutility consumer experiences as the price of the product goes up

The two-level nested logit model in this study is set up as follows. The products are divided into $H+1$ groups, $h = 0, \ldots, H$ ($h = 0$ contains only the outside option). This represents the choice people make regarding the type of carrier to travel with. Within each group h, there are subgroups $\mathrm{G_h}$, $\mathrm{g} = 0, \ldots, \mathrm{G_h}$. This denotes the choice of the airline. Each subgroup g of group h comprises of J_{gh} products.

The upper-level model which indicates the choice of nest gives the marginal probabilities of choosing product j. The lower-level model which stands for the choice of a product within a nest gives the conditional probability of selecting j, given that a specific nest is chosen. The combined selection probability, Pr (j) = Pr (Nest containing j) X Pr (j I Nest containing j). Inclusive value connects the two levels of the model. It considers the utility of choosing a specific product within a nest and uses that information to compute how attractive the nest is in the upper-level model. Given random utility maximization, the probability a consumer gets from choosing product i is:

$$P(j) = s_j(\delta, \sigma) = \frac{exp\left(\frac{\delta_j}{1-\sigma_{airline}}\right) exp\left(\frac{I_{gh}}{1-\sigma_{type}}\right) exp(I_h)}{exp\left(\frac{I_{gh}}{1-\sigma_{airline}}\right) exp\left(\frac{I_h}{1-\sigma_{type}}\right) exp(I)} \tag{4}$$

where:

- δ is a vector containing mean utilities
- σ_{type} and $\sigma_{airline}$ are the coefficients on the two nests which measure the degree of correlation between preferences

➢ I_{gh} is the inclusive value of a product within a subgroup:

$$I_{gh} = (1 - \sigma_{airline}) \ln \left(\sum_{k=1}^{J_{gh}} \exp \left(\frac{\delta_k}{1 - \sigma_{airline}} \right) \right) \tag{5}$$

➢ I_h is the inclusive value for a group or upper-level nest:

$$I_h = (1 - \sigma_{type}) \ln \left(\sum_{g=1}^{\mathrm{G_h}} \exp \left(\frac{I_{gh}}{1 - \sigma_{type}} \right) \right) \tag{6}$$

➢ I is the top-level inclusive voice, representing overall attractiveness of all products:

$$I = ln \left(1 + \sum_{h=2}^{H} \exp(I_h) \right) \tag{7}$$

The final probability of choosing a product in nested logit models depends on relative utilities and hence certain terms in equation (4) cancel out. *McFadden (1984)* demonstrates that the model aligns with random utility maximization when $0 \leq \sigma_{\text{type}} \leq \sigma_{airline} \leq 1$. If $\sigma_{\text{type}} = \sigma_{airline}$ or $\sigma_{\text{type}} = 0$ and $\sigma_{airline} > 0$, then the groups and subgroups are the nests respectively and the model gets reduced to a one-level nested logit. If both are zero, there is no correlation between products from the same groups and subgroups. This essentially represents a simple logit model.

3.1.3 Aggregate and inverted aggregate demand

Aggregate demand is derived by summing over all passengers the product of the probability of a passenger buying a product j and quantity purchased. Given the UDS specification, aggregated demands are:

$$q_j = s_j(\delta, \sigma) I \tag{8}$$

The error term ξ_j due to the unobserved product characteristics, enters in a non-linear fashion through the mean component of utility δ_j. To deal with this, inversion of the choice probabilities s_j is done and mean utilities are obtained *(Berry, 1994)*. The inverted choice probabilities are given by:

$$\delta_j = ln\left(\frac{s_j}{s_0}\right) - \sigma_{type}\, ln\left(s_{g|h}\right) - \sigma_{airline}\, ln\left(s_{j|gh}\right) \tag{9}$$

where:

- $s_{j|gh}$ refers to the probability of opting for j given a product from subgroup g of group h is chosen
- $s_{g|h}$ refers to the probability of opting for subgroup g given group h is chosen

For UDS specification, these probabilities can be written in the form of observables as:

$$s_j = \frac{q_j}{I} \tag{10}$$

$$s_{j|gh} = \frac{q_j}{\sum_{j\in G_{gh}} q_j} \tag{11}$$

$$s_{g|h} = \frac{\sum_{j\in G_{gh}} q_j}{\sum_{g=1}^{G_{gh}} \sum_{j\in G_{gh}} q_j} \tag{12}$$

Inserting equations $(10), (11)$, (12) in (9) and using $\delta_j{}'s$ specification in (3), final estimation equation is obtained which can be estimated using a regression involving instrumental variables for prices, group and subgroup shares:

$$ln\left(\frac{q_j}{1-\sum_{j=l}^{J} q_j}\right) = x_j\beta - \alpha p_j + \sigma_{airline}\, ln\left(\frac{q_j}{\Sigma_{j\epsilon G_{gh}}\, q_j}\right)$$

$$+ \sigma_{type}\, ln\left(\frac{\sum_{j\in G_{gh}} q_j}{\sum_{g=1}^{G_{gh}} \sum_{j\in G_{gh}} q_j}\right) + \xi_j \tag{13}$$

3.1.4 Instrumental variables

When estimating demand, variables like prices, group and subgroup shares are potentially endogenous because of factors like omitted variables bias, simultaneity, and reverse causality. *BLP's (1995)* strategy is followed in this study to get demand unobservables ξ_j as a function of nesting parameters, observable characteristics, and prices:

$$\xi_j \;=\; s^{-1}(\sigma,\, x_j,\, p_j) \tag{14}$$

The moment conditions are formed by interacting ξ_j with the vector of instruments z_t *(Berry and Jia, 2010)* such that the expected value of the unobserved characteristics conditional on the instruments is zero. This implies that the vector of instruments z_t is valid and satisfies the required econometric conditions for consistent estimation, which are exclusion, relevance, exogeneity, order, and rank conditions. Generalized methods of moment estimator (GMM) works when the expectation of a function of the instruments and unobserved term is zero:

$$E\left[h(z_t)\cdot\xi_j\right] = 0 \tag{15}$$

The instruments used to deal with endogeneity and get consistent estimates are detailed in section 4.4.

3.1.5 Price elasticities

The aggregate demand derivatives for UDS from equation (8) is:

$$\frac{\partial q_j}{\partial p_j} = -\alpha \frac{\partial s_j}{\partial \delta_j} I \tag{16}$$

$\partial s_j \ / \ \partial \delta_j$ can be obtained by taking the derivative of equation (4). Together (4) and (16) give:

$$\frac{\partial q_j}{\partial p_j}\frac{p_j}{q_j} = -\alpha \left(\begin{array}{c} \frac{1}{1-\sigma_{airline}} - \left(\frac{1}{1-\sigma_{airline}} - \frac{1}{1-\sigma_{type}} \right) s_{j|gh} \\ - \ \frac{\sigma_{type}}{1-\sigma_{type}} \ s_{j|h} - \ s_j \end{array} \right) p_j \tag{17}$$

Estimation of this using data gives own price elasticities. Using a similar formula cross price elasticities amongst products in different nests and within a nest can be computed. These estimates are then leveraged for merger simulation process.

3.2 MARGINAL COST ESTIMATION AND MERGER SIMULATION

The supply side is modeled as a non-cooperative oligopoly, where airlines engage in competitive pricing behavior following Bertrand competition. Airlines are unlikely to be able to adjust quantities in the short run when faced with changes in demand due to capacity constraints like airport slots and availability of aircrafts, scheduling rigidities and fixed costs.

The methodology is consistent with the approach of *Björnerstedt and Verboven (2016).* Pre-merger estimates for marginal costs are obtained using the parameters of demand estimation. Each airline a offers N_a products. Total profit for the airline is the sum of profits for each product, given the marginal cost, c_j and conduct parameter, ϕ:

$$\pi_a(\boldsymbol{p}) = \sum_{k \in N_a} (p_k - c_k) q_k(\boldsymbol{p}) \ + \ \phi \sum_{k \notin N_a} (p_k - c_k) q_k(\boldsymbol{p}) \tag{18}$$

ϕ ranges from 0 to 1, with 0 implying that there is no cooperation between airlines and 1 indicating that airlines fully cooperate and act as one big monopolist entity. *Ciliberto and Williams (2014)* find that the values for conduct parameter lies between 0 and 1 for the U.S. airline pairs. This study varies the conduct parameter post-merger to allow for the increased market power due to decrease in the number of entities and hence potential for greater collusion.

The price of each product that maximizes profits under Bertrand competition is calculated using the first-order conditions for (18):

$$\frac{\partial \pi_a(\boldsymbol{p})}{\partial p_j} = q_j(\boldsymbol{p}) + \sum_{k \in N_a} (p_k - c_k) \frac{\partial q_k(\boldsymbol{p})}{\partial p_j} + \phi \sum_{k \notin N_a} (p_k - c_k) \frac{\partial q_k(\boldsymbol{p})}{\partial p_j} = 0 \quad (19)$$

From the equation, a price change for a product by an airline affects the demand of the same product and other products of the same airline as well as the demand of products of other carriers weighed by the conduct parameter.

In matrix notation,

$$\boldsymbol{q}(\boldsymbol{p}) + \big(\boldsymbol{\theta} \cdot \Delta(\boldsymbol{p})\big)(\boldsymbol{p} - \boldsymbol{c}) = 0 \quad (20)$$

where:

- $\boldsymbol{q}(\boldsymbol{p})$ is the $J \times 1$ demand vector
- $\boldsymbol{\theta}$ is $J \times J$ product ownership matrix with diagonal elements, representing both products by the same airline, equal to 1 and off-diagonal elements equal to ϕ. If ϕ = 0, it reflects the absence of coordination amongst airlines
- $\Delta(\boldsymbol{p})$ = $\frac{\partial \boldsymbol{q}(\boldsymbol{p})}{\partial \boldsymbol{p}'}$ is the $J \times J$ Jacobian matrix of first derivatives
- $\boldsymbol{c}$ is $J \times 1$ marginal cost vector

Equation (20) can be inverted to obtain the price vector:

$$\boldsymbol{p} = \boldsymbol{c} - \big(\boldsymbol{\theta} \cdot \boldsymbol{\Delta}(\boldsymbol{p})\big)^{-1} \boldsymbol{q}(\boldsymbol{p}) \quad (21)$$

Price has two components: 1) marginal cost 2) markup over the price which depends on own-price and cross-price elasticities (if $\phi \neq 0$). This equation calculates the pre-merger marginal cost vector using pre-merger prices and elasticities from demand estimation:

$$\boldsymbol{c}^{pre} = \boldsymbol{p}^{pre} + \left(\boldsymbol{\theta}^{pre} \cdot \boldsymbol{\Delta}(\boldsymbol{p}^{pre})\right)^{-1} q(\boldsymbol{p}^{pre}) \qquad (22)$$

Potential changes in efficiency post-merger can lead to changes in marginal costs, resulting in a $\boldsymbol{c}^{post}$ and product ownership matrix changes to $\boldsymbol{\theta}^{post}$. New price equilibrium can be simulated using fixed point, potentially incorporating a dampening parameter in the markup term to stabilize the process. Alternatively, Newton method could be employed.

3.3 CONSUMER SURPLUS

Following *Bonnet and Dubois (2010)*, consumer surplus is given by :

$$CS\left(p_j, x_j\right) = \frac{1}{|\alpha|}\, ln\left(\sum exp\left[V_{ij}(p_j, x_j)\right]\right) \qquad 23$$

where:

- V_{ij} represents the systematic part of the utility
- α is the price coefficient from demand estimation

4 VARIABLES AND DATA

4.1 DATASET

The data for this study is calculated from different sources. The primary dataset leveraged is the Airline Origin and Destination survey (DBIB)[11] published by U.S. Department of Transportation (DoT), a quarterly 10% sample of all domestic airline tickets within USA starting 1993. The dataset has three different sub-components: market, coupon, and ticket databases. The dataset records a variety of information for each itinerary and its multiple segments like origin, destination, number of layovers, miles flown, and fare. All of these are used for demand estimation. The time frame considered for this analysis is from 2023-Q1 to 2024-Q1, which is the latest available data.

Frequency was constructed using U.S. DoT's T-100 Air Carrier Statistics dataset[12]. The 'departures performed' column was used that gives the number of takeoffs by each carrier between a given pair of origin and destination pair. On-time arrival performance data is calculated using U.S. DoT's Airline on-time performance dataset[13]. Data related to population has been taken from the US Census Bureau[14], using the latest available estimates from 2023.

4.2 SAMPLE SELECTION

The data is narrowed at product level first and then subsequently at market level. This is in line with methodologies of Peters (2006) and Berry and Jia (2010).

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[11] Source URL: https://www.transtats.bts.gov/tables.asp?QO_VQ=EFI&QO_anzr=Nv4yv0r

[12] T-100 Domestic segment (all carriers). Source URL: https://www.transtats.bts.gov/Tables.asp?QO_VQ=EEE&QO_anzr=Nv4%FDPn44vr4%FDf6n6v56vp5%FD%FLS14z%FDHE%FDg4nssvp%FM-%FDNyy%FDPn44vr45&QO_fu146_anzr=Nv4%FDPn44vr45

[13] Reporting carrier on-time performance dataset. Source URL: https://www.transtats.bts.gov/tables.asp?qo_vq=EFD&QO_anzr=

[14] Source URL: https://www.census.gov/data/tables/time-series/demo/popest/2020s-total-metro-and-micro-statistical-areas.html

The criteria for sample selection are as follows. Firstly, the data is filtered to include only round-trip itineraries within United States containing at most 4 coupons because factors affecting demand for one way ticket are different than a return trip. The prices for each itinerary are adjusted for inflation[15] to account for fare increases attributed to inflation. Itineraries with prices below $25 and above $3000 have been dropped. The lower bound is to eliminate tickets that are purchased using frequent flier miles or employee discounts and the upper bound is to restrict the sample to coach class travel. Further, those tickets that include a carrier change are excluded as this will fail to comply with the definition of a product, which is a unique airline-itinerary combination. Any itineraries that include ground segments are excluded as this impacts the distance travelled variable. The nine largest airlines that contribute to more than 90% of domestic market share are individually classified and the rest are grouped together to aid computation.

Table 1: Domestic market share of U.S. airlines[16]

Airline	**Domestic market share (%)**
Delta	17.8
American	17.4
SouthWest*	17.4
United	16.0
Alaska	6.1
Spirit*	5.1
JetBlue*	4.9
Frontier*	3.6
SkyWest	2.3
Others	9.4
Total	100

Note: * denotes the LCCs

At the market level, the study considers small and medium metropolitan areas with population of more than 8,50,000. This is because demand and

[15] U.S Bureau of Labor statistics. Source URL: CPI Inflation Calculator (bls.gov)
[16] Source URL: https://www.transtats.bts.gov/

cost of operation among small sized markets is different than larger cities and might not be captured by this model *Berry and Jia (2010)*. Market size, as defined by *Berry (1994)* and *Berry, Carnall and Spiller (1996)*, is the geometric mean of the two end point cities of an itinerary.

HMG stresses on the importance of carefully defining the relevant market as it forms the foundation for analyzing a merger's competitive effects. With both the airlines involved in the merger being LCCs, they likely attract more price-sensitive customers and hence demand for markets they serve are likely to be different. Hence, the relevant market is defined as those markets which are served by at least either Spirit or JetBlue[17].

4.3 VARIABLES INCLUDED

1) **Ticket fare:** The expected demand falls as fares increase because consumers receive disutility by paying more for a journey.
2) **Number of layovers:** Travelers generally prefer direct flights due to a combination of factors such as increased travel time, inconveniences, potential delays and discomfort associated with higher number of connections. More the number of layovers, lesser is the expected demand for an airline's product
3) **Distance:** The expected demand tends to go up with distance as air travel becomes the most efficient and convenient option and the competition from other modes of transportation becomes less and less stiff.
4) **Squared distance:** *Berry and Jia (2010)* argue that as the squared distance increases, the expected demand goes down because of greater fatigue and discomfort. This variable captures the inverse U-shaped relationship between distance and demand beyond a certain threshold.
5) **Flight frequency:** The more the number of flights offered to a consumer, the greater the convenience, flexibility, and reliability and hence the expected demand tends to go up. This is calculated as the number of

[17] This includes the overlap markets where both Spirit and JetBlue operate too.

quarterly departures between origin and destination airport by an airline for direct flights. For connecting flights, it is calculated as the geometric mean of the departures for each outbound segment, in line with the *Peters (2006).*

6) **Tourist status of destination:** *Berry and Jia (2010)* incorporate a dummy variable for the tourist status of certain destinations that are expected to have higher demand throughout the year. The destination cities are New York, Miami, Los Angeles, Orlando, San Francisco, and Las Vegas.
7) **Hub status for the airline:** This dummy variable reflects if the origin station is a hub for a given airline. The expected demand goes up because of enhanced connectivity, operational efficiencies and brand dominance.
8) **On-time arrival:** The expected demand goes up as an airline's on-time arrival performance at the origin improves because flyers expect disruptions to their planned itineraries to be minimized. Although while booking consumers are unaware of the flight arrival status, *Mazzeo (2003)* states that flyers form expectations regarding flight delays through past on-time performance records of airlines. *Hsiao and Hansen (2011)* find that travelers avoid flights with connections at airports with high expected delay. It is calculated as the percentage of all flights that arrived within 15 minutes of scheduled arrival time.
9) **Year-Quarter, Airline specific dummies:** These are added to consider the product characteristics that are unobserved. This accounts for factors like seasonality of travel demand, changing operational challenges, and brand loyalty.

Table 2: Summary statistics of variables included in demand estimation

Dependent variable	**Mean**	**Std. Dev.**	**Min**	**Max**
Ticket fare (USD)	220	89	25	2876
Frequency	397	265	2	1410
No. of layovers	0.114	0.325	0	2
Miles flown (10^3 miles)	1.189	0.576	0.255	4.617
Squared miles flown (10^6 miles)	1.744	1.649	0.065	21.317
On-time arrival (%)	77	6.680	23.077	95.865
Hub status of origin[18]	0.488	0.498	0	1
Tourist status	0.350	0.477	0	1

There are still numerous unobservable factors that influence demand but are not directly accounted for in the observable data. These are factors like participation in frequent flier programs and seat selection options, collectively captured in the term ξ_j.

4.4 INSTRUMENTAL VARIABLES

Last step before estimation is to identify appropriate instruments to control for the potential correlation between observed and unobserved product characteristics. This is important because if endogeneity is not addressed adequately, it can result in biased and inconsistent estimates. For demand estimation in airline industry, price, flight frequency, group and subgroup shares are likely endogenous.

Prices are endogenous because of simultaneity as they affect demand and are also influenced by demand. Prices are also correlated with unobserved factors that also impact consumer choices like service quality and brand loyalty. This study uses Peters' (2006) rationale to conduct instruments that the overall network of airlines is exogenous to unobserved factors that drive

[18] For direct and connecting flights, it is the status of the primary origin.

consumer utility. The reasoning is in line with BLP's (1995) discrete-choice demand estimation.

The instrument vector for price consists of 1) observable characteristics of other products offered by the carrier and its competitors. These factors determine the degree of substitutability of the product because higher the number of similar options in the market, the more competitive the pricing would be. Characteristics of market-level competitors comprise of the average distance, number of direct flights, number of competitors and average number of products offered between the origin and destination market 2) Cost shifters like hub status of the origin and destination airport and the number of slot-controlled airports along the itinerary. These affect the pricing of the products without affecting demand. *Berry, Carnall and Spiller (1996)* find that hubs are a significant part of production for carriers and provide notable cost savings owing to the presence of economies of density. Slot controlled airports are airports where number of takeoffs and landings are regulated, and carriers need to buy slots. This is an additional cost and does not affect demand.

Group and subgroup shares are directly related to the dependent variable and hence are endogenous. These shares are also impacted by the same demand shocks that affect consumer choices. For example, an economic downturn resulting in reduced disposable income will affect consumer demand and will likely shift preferences towards LCCs. *Peters (2006)* instruments are leveraged in this study which include number of products offered at each airport by the airline and its competitors and average of other product level characteristics like distance, connections, and number of hubs along the itinerary.

Flight frequency is endogenous as at can be adjusted by the carriers based on demand that they experience or anticipate on a route, at least in the long run. Greater demand prompts carriers to increase flight frequency to accommodate more flyers. This results in flight frequency being impacted directly by the factors that affect demand. Instruments considered are in line with *Peters (2006)* and *Berry and Jia (2010)*. It includes the average MSA population of the origin and destination cities, their hub status, and number of products available by competitors within that market. All these factors should positively impact frequency. Slot controlled airport status is also included as it adversely impacts frequency by imposing operative restrictions.

5 RESULTS

5.1 DEMAND ESTIMATION

The result from the demand estimation process for markets where both or either Spirit or JetBlue have presence are as follows:

Table 3: Two-level nested logit demand parameters

Dependent variable	Coefficient (Two-level nested logit)	Std. err
Inflation adjusted fare (USD)	-0.007409***	0.000397
Frequency	0.002880***	0.00009
Number of connections	-0.530***	0.020
Miles flown (10^3 miles)	0.345***	0.039
Miles flown squared (10^6 miles)	-0.232***	0.028
Tourist status of destination	0.133***	0.013
Hub status of origin*	0.472**	0.472
On-time arrival	-0.0003054***	0.00073
σ_{type}	0.570***	0.0092
$\sigma_{airline}$	0.615***	0.0058
United	0.629***	0.036
Delta	0.818***	.045
Frontier	-0.559***	.059
JetBlue	-0.468***	.041
Alaska	0.415***	.051
American	0.364***	.030
Spirit	-0.693***	.053
SkyWest	0.392***	.064
Others	0.378***	.045
Q2 2023	0.192***	.0078721
Q3 2023	-0.079***	.0088489
Q4 2023	0.069***	.0078971
Q1 2024	-0.044***	.0065531
Total passengers	22,575,594	
Total Products	216,279	
Total Markets	13,446	

Notes:

1. * refers to significance at 10% level, ** at 5% level, and *** at 1% level.
2. Q1 2023 and SouthWest dummies are omitted due to collinearity.
3. Travels on same itinerary but occurring in different quarters and years are considered as different products in different markets.

The fare coefficient is negative, which is in line with the law of demand. It represents the disutility passengers experience when they pay more for a ticket. Expected a priori, parameters for flight frequency and number of connections are positive and negative respectively. The higher the flight frequency, the higher the likelihood that people will get a flight according to their schedule and convenience. The negative coefficient for number of layovers indicates consumer's preference for direct flights. Having to go through an additional stop at the connecting airport leads to a relatively less smoother travel experience. Moreover, the coefficient is likely to underestimate the value consumers place on minimizing the layovers because of the lack of flight options to fly non-stop to their destination. This is especially true for carriers that operate on a hub-and-spoke model.

Miles flown coefficient is positive as expected because initially as the distance increases, the attractiveness of air travel goes up because of decreasing feasibility of other modes of transport. However, long flights can be inconvenient and uncomfortable leading to disutility, which is reflected in the negative coefficient for miles flown squared variable.

Dummy for tourist status of the destination is positive, indicating the high overall demand for certain destinations that are popular amongst tourists. This effect is more prominent for markets where LCCs have their presence because they serve tourists more than business travelers. Dummy variable representing hub status of the origin airport has a positive coefficient[19]. Carriers at their hubs offer large number of direct and connecting flights to multiple destinations and hence attract a lot of consumers. Heavy investment in hub airports also results in better amenities and lounges which adds to consumer utility.

A negative coefficient, although statistically not significant, for on-time arrival performance was not expected. Reverse causality might be at play with airlines having fewer passengers and less congestion being able to operate on time as opposed to airlines with high demand that struggle with

[19] It is the hub status of the primary origin for both direct and connecting flights.

delays due to operational constraints. Secondly, price sensitive leisure travelers flying with LCCs also might not prioritize on-time performance a lot. Lastly, it can be due to lack of credible reporting of flight status or missing data, mainly for certain small carriers in the 'others' category.

The coefficients for σ_{type} and σ_{airline} are such that they validate the two-level nested logit specification:

$$0 \leq 0.570 = \sigma_{\text{type}} \leq \sigma_{\text{airline}} = 0.615 \leq 1$$

The two estimates are also in line with *McFadden's (1984)* random utility maximization.

Q4 of 2023 experienced comparatively higher demand than Q1 of 2023 likely because of people travelling to meet their families and friends during Thanksgiving and Christmas holidays. Demand on considered routes in Q3 of 2023 being lower relative to Q1 of 2023 was not a priori expectation. It was expected to be higher because of peak season summer travel in those months. This could be because of greater travel access to international markets for Americans compared to previous summer as the post pandemic recovery was still happening back then and travel restrictions were easing. Owing to trends starting to normalize, 2023 had lesser domestic substitution of vacations abroad. *(J.P. Morgan, 2023)*. U.S. International Trade Administration data found that Americans flying out of U.S. in 2023 through July exceeded pre-pandemic levels *(Forbes, 2023)*.

5.2 PRE-MERGER MARKET CONDITIONS

Justice Department purported that the Spirit and JetBlue merger would harm the consumers by raising prices by 30%, especially in markets where the two airlines have a large presence. This provides grounds to focus on routes where both the carriers operate and compete as they will be impacted the most. This study also looks at those routes where either of the carrier flies, since it is likely that post-merger airlines will raise fares on non-overlapping routes too because of increased market power.

Peters (2006) highlighted that the merger simulation in the airline industry can benefit by a more flexible model for firm conduct than Nash Bertrand[20]. This study hence considers partial collusion between airlines. The degree of strategic interaction between carriers is captured by the conduct parameter. The higher the value, greater is the degree of collusion. *Ciliberto and Williams (2014)* estimate the conduct parameters for pairs of U.S. carriers depending on the level of their multimarket contact. For Q1 of 2007, the values range from 0.040 amongst LCCs and between legacy carriers and LCCs to 0.935 between United and Delta airlines. Considering the high competition in most domestic markets and significant regulatory scrutiny, this study sets the conduct parameter arbitrarily at 0.3. A value of 0.3 implies that carriers internalize the profits of competitors by 30% when making pricing decisions. After the merger, the study again arbitrarily assumes that the conduct parameter goes up by 0.05 in both overlapping and non-overlapping markets. There is no definite measure that reflects the exact degree of collusion in the airline industry as it depends on several factors like degree of overlap between markets and code sharing agreements. Also, there is not enough research on this front leading to the use of arbitrary estimates.

[20] Merger simulation results with Nash Bertrand are given in the appendix.

5.2.1 Elasticities

This step involves calculating the elasticities of demand prior to the merger. This study considers two subsets: 1) overlapping markets where both Spirit and JetBlue operate and 2) non-overlapping markets where either Spirit or JetBlue operates.

Table 4: Own- and cross-price elasticities for overlapping markets

ELASTICITY	OVERLAPPING MARKETS			
	Mean	Std. Dev.	Min	Max
Own price	-5.344	3.005	-55.350	-0.434
Cross-price:				
1) Same subgroup	0.181	0.429	0.000	5.222
2) Different subgroup	0.103	0.321	0.000	4.311
3) Different group	0.000	0.000	0.000	0.005

Note: Elasticities are unweighted averages

Table 5: Own- and cross-price elasticities for non-overlapping markets

ELASTICITY	NON-OVERLAPPING MARKETS			
	Mean	Std. Dev.	Min	Max
Own price	-4.929	2.553	-52.546	-0.276
Cross-price:				
1) Same subgroup	0.311	0.543	0.000	6.028
2) Different subgroup	0.187	0.415	0.000	5.003
3) Different group	0.000	0.000	0.000	0.003

Note: Elasticities are unweighted averages

The magnitude of own-price elasticities for both subsets are on the higher end. There can be several reasons for that. Firstly, the sample used to estimate demand is restricted to specific markets where Spirit or JetBlue operate. Since these are LCCs, flyers travelling with these carriers and on these routes are comparatively more price sensitive. *Lederman and*

Januszewski (2003) find that LCCs are more likely to operate on routes that already have established carriers, leading to higher price competition. Secondly, the filtered fare range is likely to exclude coach class round trips which comprises of many business travelers. Tourists are more price sensitive than business travelers. This is supported by the estimates of *Proussaloglou, K., & Koppelman, F. S. (1999). Berry and Jia (2010)* found elasticities ranging from -4 to -8 for tourist-type customers. Additionally, these elasticity estimates are unweighted and hence can be unduly impacted by less representative observations like certain routes with less frequent flights and low seat factors. The magnitude and order of cross-price elasticities for both subsets imply that carriers within the same lower nests (carrier choice) are most substitutable, followed by carriers within different lower nests and lastly carriers in different upper nests (carrier type) are least substitutable. This justifies the two-level nested logit structure.

The average number of market competitors for overlapping markets is 7, whereas it is 6 for non-overlapping markets. This justifies the higher elasticity for former subset because of presence of greater number of substitutes. Cross price elasticity in overlapping markets for the same subgroup is lower compared to non-overlapping markets because of presence of an additional similar option that consumers can switch to in case of a price change.

5.2.2 Marginal costs and Lerner index

Table 6 gives pre-merger marginal costs recovered using the coefficients from the demand analysis, elasticities, and the assumption of partial collusion with a conduct parameter of 0.3 between carriers. The pre-merger Lerner[21] is computed and it gives a measure of competitiveness. Higher values of the index suggest reduced competition because firms can apply greater markups without losing consumers to competitors.

Table 6: Pre-merger market conditions

Airline	OVERLAPPING MARKETS			NON-OVERLAPPING MARKETS		
	Pre-merger Fare (USD)	Marginal cost (USD)	Lerner Index	Pre-merger Fare (USD)	Marginal cost (USD)	Lerner Index
American	317	222	0.340	308	216	0.333
Alaska	340	258	0.310	299	209	0.369
JetBlue	242	153	0.426	217	126	0.483
Delta	386	291	0.294	348	258	0.303
Frontier	115	29	0.844	109	27	0.860
Spirit	135	50	0.732	121	36	0.813
SkyWest	315	239	0.300	300	219	0.326
United	352	262	0.302	328	239	0.317
SouthWest	259	158	0.427	254	139	0.495
Others	268	187	0.395	265	178	0.431

Note: All costs and fares are unweighted averages and rounded off to the nearest USD

Frontier and Spirit have particularly low marginal costs and high values for Lerner index. The own-price elasticity for Frontier and Delta are -1.78 and -6.38 respectively, which explains the difference in Lerner index values for the two airlines. High Lerner index values for Frontier and Spirit provide support to the emergence of a distinct airline business model, referred to as ultra-low-cost carriers (ULCCs) *(Bachwich & Wittman, 2017).* These carriers

[21] Lerner $= \frac{Price - Marginal\ cost}{Price}$

offer unbundled tickets that only include the base seat fare from origin to destination and all the other services like in-flight entertainment, food & beverage, and checked baggage are available by paying extra *(Vinod & Moore, 2009)*. J.D. Power consumer insights study[22] on North American Airline satisfaction study highlights that Frontier has the lowest overall customer satisfaction index ranking in 2024, followed by Spirit. Southwest ranks highest in overall customer satisfaction, followed by Delta Airlines[23]. Combined with significantly lower average fares, this also indicates that Frontier and Spirit prioritise competitive pricing over service differentiation.

Delta and United have the lowest Lerner index values, reflecting that the legacy carriers operate with high marginal costs and face stiff competition which limits their ability to increase prices.

[22] Source URL: https://www.jdpower.com/business/press-releases/2024-north-america-airline-satisfaction-study

[23] These rankings are for Economy/Basic Economy class travel, which is the focus of this study.

5.3 POST-MERGER PRICE PREDICTIONS

5.3.1 Overall price changes

Table 7 shows the pre- and post- merger fares and percentage change in fares because of the merger. The modelled merger relies on several assumptions. Firstly, it assumes no changes to the products offered by the merging carriers, or their characteristics post the merger. Secondly, the value of the outside option is assumed to not change post-merger. Lastly, no short-term efficiency gains are considered for either airline[24]

Table 7: Post-merger market changes

Airline	OVERLAPPING MARKETS			NON-OVERLAPPING MARKETS		
	Pre-merger Fare (USD)	Post-merger Fare (USD)	Percent change	Pre-merger Fare (USD)	Post-merger Fare (USD)	Percent change
American	317	319	0.8	308	310	0.9
Alaska	340	343	1.1	299	302	1.0
JetBlue	242	253	5.4	217	220	1.4
Delta	386	388	0.7	348	350	0.8
Frontier	115	118	2.8	109	112	3.1
Spirit	135	146	9.3	121	124	2.7
SkyWest	315	318	1.2	300	303	1.2
United	352	355	0.8	328	330	0.9
SouthWest	259	261	1.0	254	255	0.5
Others	268	271	1.4	265	267	1.2
Total passengers	12,477,715			10,097,879		
Passenger weighted increase	2.14%			1.05%		

Notes:
1) All fares are unweighted averages and rounded off to the nearest USD
2) Percentage change is given to 1 DP

[24] This assumption is examined later in the paper.

For overlapping markets, fares for Spirit and JetBlue will increase by 9.3% and 5.4% respectively. For non-overlapping markets, the percentage change in fares for Spirit and JetBlue are 2.7 % and 1.4% respectively. The increase in passenger weighted average price is 1.05% for non-overlapping markets. It more than doubles for overlapping markets and is 2.14%. A potential reason for the significant price increase for Frontier is discussed under unilateral effects in section 5.4.1.

5.3.2 Consumer surplus

Table 8: Average change in consumer surplus post-merger

	Overlapping markets	**Non-overlapping markets**
Decline in consumer surplus (%)	**0.17**	**0.09**

Change in consumer surplus is calculated to measure the impact on consumer welfare post-merger. Consumer surplus is expected to go down on average by 0.17% in overlapping markets and 0.09% in non-overlapping markets.

5.3.3 Impact on non-stop overlap markets

Table 9 presents the passenger weighted increase in fares post-merger for some[25] of the key non-stop markets where JetBlue and Spirit compete closely:

Table 9: Price change post-merger for selected non-stop markets

BI-DIRECTIONAL MARKET[26]	**PASSENGER WEIGHTED PRICE RISE (%)**	**MARKET SERVED BY SPIRIT AND JETBLUE (%)[27]**
Miami/Fort Lauderdale, FL – New York City, NY	11.86	41
New York City, NY – Orlando, FL	9.94	51
Boston, MA – Miami, FL	11.65	55
Los Angeles, CA – Miami/Fort Lauderdale, FL	4.41	41
Las Vegas, NV - New York City, NY	3.93	29
Boston, MA – Orlando, FL	8.28	56
Las Vegas, NV – Miami/Fort Lauderdale, FL	6.21	47
New Orleans, LA – New York City, NY	2.66	26
Boston, MA – Tampa, FL	6.14	61
Hartford, CT – Orlando, FL	5.77	55
Boston, MA - Las Vegas, NV	4.35	67
Miami/Fort Lauderdale, FL – New Orleans, LA	7.98	47
Hartford, CT – Miami/Fort Lauderdale, FL	8.04	80
Orlando, FL – Richmond, VA	34.21	100
Miami/Fort Lauderdale, FL – Richmond, VA	24.28	75

[25] In line with the scope of the study, Caribbean and Latin American markets and cities with MSA population less than 8,50,000 are not considered.
[26] The markets are non-directional, including non-stop flights both to and from the origin city.
[27] Combined market share served by JetBlue & Spirit is calculated with the survey responses.

Notes:
1) Combined market share served by JetBlue and Spirit is calculated using the survey responses.
2) Passenger weighted price increase is given to 2 DP

Orlando-Richmond and Miami/Fort Lauderdale-Richmond bi-directional markets stand out with passenger weighted fare increase of 100% and 75% respectively. This is because JetBlue and Spirit combined serve 100% and 75% of the non-stop demand between these two cities. The merger will result in elimination of competition on these routes. JetBlue and Spirit account for more than 40% of most of above mentioned the market. These statistics provide support to DOJ’s claim that the merger is likely to lead to higher fares and fewer options for travelers, especially in certain non-stop markets where the two carriers have major presence. This will particularly hurt cost-conscious travelers as it will virtually eliminate all or major proportion of the competition in these markets.

5.4 POST-MERGER COMPETITIVE EFFECTS

5.4.1 Unilateral effects

HMG defines unilateral effects resulting from a merger to be the ability of the merged entity to raise prices or decrease quantity unilaterally, without the need to coordinate with other firms. This can happen because the merged firm gains greater control over hitherto substitutes and hence an increase in prices leads to recapturing some of the diverted sales internally.

The potential risk of unilateral effects can be analysed using diversion ratio[28]. Diversion ratio is commonly used by competition authorities to review mergers as it is directly related to the likelihood of unilateral effects after a merger. The closer two products are as substitutes for one another, the higher the diversion ratio between them.

Since the two merging airlines are LCCs, the study focuses on the substitution patterns between LCCs. The cross-price elasticity[29] between JetBlue and Spirit is 0.434, which is higher than for other pair of LCCs as shown in table 10. This indicates that the products of the two carriers are close substitutes and hence the merger can be detrimental to consumer welfare.

Table 10: Cross-price elasticities for a subset of LCCs

	Spirit Airlines	**JetBlue Airways**
Frontier Airlines	0.238	0.413
SouthWest Airlines	0.156	0.195

[28] The diversion ratio measures the percentage of a firm's lost sales, following a price increase, that are recaptured by a competing product or firm.
[29] The price elasticities are for overlapping markets where both JetBlue and Spirit have presence

Frontier's cross-price elasticity with JetBlue and Spirit is significantly higher than Southwest. Given that the model shows that JetBlue-Spirit merger will result in higher prices for those two carriers, as indicated in Table 7, Frontier will capitalize on the opportunity to raise its own prices due to reduced competitive pressure. The combination of its higher cross-price elasticities and relatively low own-price elasticity (-1.78) suggests that Frontier will likely retain sufficient demand to make such a price increase profitable.

5.4.2 Herfindahl-Hirschman index (HHI)

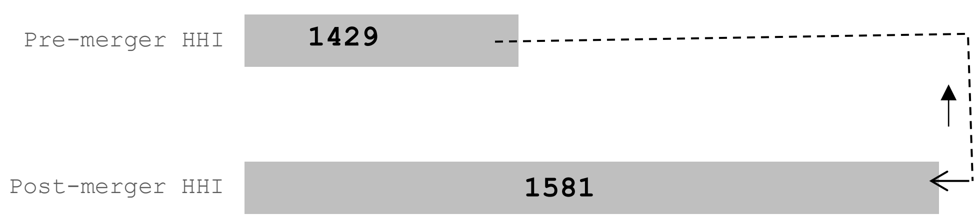
HHI is a common measure of market concentration and is leveraged to evaluate competitiveness pre- and post-merger. It is obtained by summing the squared market share of each airline.

In accordance with guidelines from DOJ and FTC[30], industries with an HHI below 1,000 are considered unconcentrated and mergers in such markets generally don't need to be analyzed. HHI between 1,000 – 1,800 represents industries that are moderately concentrated, and mergers than increase HHI by more than 100 points raise competitive concerns that need approval. For highly concentrated industries with HHI over 1,800, mergers resulting in an HHI increase of more than 50 points triggers competitive concerns.

FTC often focuses more on larger firms as they dominate the market activity and are more likely to affect competition. HHI is calculated considering the average market shares for all the overlapping markets of JetBlue and Spirit for the 9 airlines with the largest market shares. The increase in HHI post-merger is 152 points, warranting the significant competitive concerns regarding the merger.

[30] Source URL: https://www.justice.gov/atr/horizontal-merger-guidelines-0

Figure 3: Change in average HHI across markets post-merger



DOJ and FTC state that while HHI provides a starting point, it needs to be supplemented with other measures to get a comprehensive assessment of the competitive dynamics. This is because it does not consider factors that govern market dynamics like entry and exit of firms and most importantly, geographical limitations as it does not focus on the nuances of individual markets which differ significantly in terms of concentration of firms.

5.4.3 Efficiency gains

Mergers are characterized by a dichotomy between increase in market power, leading to price increases that reduce consumer welfare, and realization of efficiencies that can improve welfare. A merger can result in efficiencies and synergies through several mechanisms that enable the merged entity to reduce costs, improve operations, and raise its competitive position. Key mergers like American Airlines and US Airways (2013) and United Airlines and Continental Airlines (2010) led to revival of financially struggling legacy carriers which are thriving at present.

Coate and McChesney (1992) conducted a statistical analysis of 70 sample horizontal mergers reviewed by the FTC between 1982-86. Their findings indicated that efficiency considerations did not play a role in the agency's decisions to challenge mergers during that time. However, the situation has changed over the years. Cost efficiencies and synergies were an important consideration for Spirit and JetBlue merger, discussed in detail in the complaint[31] filed against it by the authorities.

Efficiency gains take time to materialize as the merged entities align their workings and adjust their strategies, making it hard to model them into a static simulation. Despite these complexities and delays in effects, the model can still provide insights into how much cost-saving is required for the merger to avoid price hikes. The minimum passenger weighted efficiency gain needed for prices to remain unchanged is 10.3% for the markets that are served by both JetBlue and Spirit.

In antitrust assessments, the key challenge with merger efficiencies lies in evaluating their plausibility, likelihood of realization, and impact on post-merger competition. Merging firms often possess significant informational advantages about the existence and scale of efficiencies. *Amir et al. (2009)* demonstrate that firms are incentivized to overstate efficiencies to both antitrust authorities and rivals to secure merger approval and convince rivals regarding the competitiveness of the merged entity.

[31] Source URL: https://www.justice.gov/atr/case-document/file/1573131/dl

6 LIMITATIONS AND DISCUSSION

The simulation results indicate that the JetBlue-Spirit merger would have likely harmed consumers through price increases, particularly in markets where both the carriers have major presence. However, several other important factors need to be considered when assessing a merger. These include the potential effects on customer experience, service quality, and labor force. These aspects cannot be measured with the current data but are crucial for a more thorough evaluation of the merger's overall impact.

The validation of the simulation critically depends on the accuracy of demand estimation. While nested logit model used for demand estimation offers the advantage of segmenting choices and is an improvement over the restrictive assumptions of the basic logit, it has its shortcomings. It has difficulty capturing differences in preferences among various customer groups like business and leisure travellers which prioritize different aspects of air travel. *Delahaye et al. (2017)* supplement discrete choice modelling with a machine learning module to obtain distinct price sensitivities for different customer segments and find that the approach improves accuracy when modelling the itinerary choice of air travellers. The instruments for endogenous variables are chosen assuming that airline network is largely exogenous. *Aguirregabiria and Ho (2012)* endogenize airline network and show how airlines consider operating on specific city-pairs based on its impact on other related routes.

The merger simulation assumptions on which the model is based might not be accurate. The product characteristics are assumed to remain unchanged pre-and post-merger. The consumer surplus too is likely to be impacted by changes in characteristics of products post-merger. *Lee (2013)* endogenizes product characteristics in a two-stage oligopoly model and finds that firms tend to increase product differentiation post-merger, which influences their incentive to increase prices. They also find that it better predicts the realized post-merger outcome for Delta and Northwest airlines. Efficiencies and synergies post-merger can result in change in marginal costs, but the study assumes it to be same. *Khezrimotlagh et al. (2022)* based on 4 U.S. airline mergers found that irrespective of their capacity size, airlines operate more efficiently post-merger. *Peters (2006)* suggested that the merger simulation could improve with a more flexible model than Nash Bertrand. This study arbitrarily assumes partial coordination between airlines with a conduct parameter of 0.3. This may not accurately reflect firm interactions or the market power of airlines. More research on pricing strategies and competitive dynamics could improve the model's reliability, particularly regarding initial marginal costs, which depend heavily on assumptions about airline competition.

7 CONCLUSION

The Spirit-JetBlue proposed merger after undergoing a series of negotiations and regulatory hurdles since July 2022 was eventually terminated in March 2024. Because of the recency of events, there has not been significant research on the potential competitive effects of the merger. This study aims to add to the literature of airline mergers by leveraging recent data.

The study aligns with FTC's Horizontal Merger Guidelines and aims to assess anticompetitive effects through a merger simulation model with partial coordination between airlines. The simulation involves demand estimation in a relevant market, computation of pre-merger market conditions based on an estimated supply model, and lastly the actual merger simulation that predicts the resulting price changes.

For demand estimation, a discrete-choice model is used following the relevant literature in the field *(Peters, 2006; Berry and Jia, 2010)*. The model specification employed is a two-level nested logit: first, the consumer decides on a type of carrier (Others vs LCC), and then at the second level, opts for a specific airline-itinerary combination (a product). The two-level structure captures the nuances of consumer preferences more effectively, allowing for a more precise estimation of demand in the context of airline choices. The relevant market comprised of city-pairs where at least either JetBlue or Spirit has presence.

For merger simulation, the analysis is divided into two subsets: markets where Spirit and JetBlue overlap, and non-overlapping markets where only either airline operates. Price elasticities for overlapping and non-overlapping markets are -5.34 and -4.93 respectively. The estimated elasticities are relatively high but consistent with the findings for price-sensitive tourists, which are likely to be the majority in the defined market. A merger simulation is performed using demand parameters estimated for overlapping and non-overlapping markets of the merging airlines. Actual simulation is conducted post estimating pre-merger marginal costs and

Lerner index, which results in a passenger weighted average price increase of 2.14% and 1.05% for overlapping and non-overlapping markets respectively. Average consumer surplus is found to decline by 0.17% in overlapping markets and 0.09% in non-overlapping markets.

A deeper dive into some non-stop markets where Spirit and JetBlue compete aggressively pre-merger highlight significant price increases for markets like Orlando, FL – Richmond, VA and Miami/Fort Lauderdale, FL – Richmond, VA. This is either due to the two carriers serving a large majority of customers or being the only carriers operating non-stop in those markets.

The study examines additional measures to assess the merger's competitive impact. The post-merger HHI increase of 152 points raises concerns under HMG guidelines, as the U.S. domestic airline industry is moderately concentrated on average across markets. The cross-price elasticities between Spirit and JetBlue products are higher than those of other LCC carriers, suggesting that their products are close substitutes. This raises concerns about the potential for unilateral effects because of the merger. The passenger weighted efficiency gain required on overlapping markets post-merger is 10.3%, further raising concerns regarding the merger. These are generally realized in medium to long run and their transfer to consumers depends on market power and regulatory oversight.

The merger simulation appears to have an overall negative impact on consumers, especially in non-stop markets where Spirit and JetBlue have major presence. The findings extend support to the decision of authorities to block the merger. However, the demand estimation model employed has limitations that may affect the precision of the results. It does not account for evolving consumer behavior and changes in competitive responses, which would have better captured the merger’s long-term impact. The merger simulation model assumes marginal costs, products, and product characteristics to remain unchanged post-merger, but several studies do suggest potential changes. The market conduct parameter is arbitrarily set, warranting further research for accurate estimation.

The decision by the Department of Justice (DOJ) and the Federal Trade Commission (FTC) to block the JetBlue-Spirit merger represents a notable shift in the regulatory approach towards airline industry consolidation in the U.S. It contrasts with the more lenient scrutiny applied to previous mergers, such as Delta-Northwest, United-Continental, and American-US Airways. The authorities in the past This is indicative of a new focus on maintaining competitive market structures, protecting low-cost carrier competition, and addressing broader concerns related to market concentration in the airline industry.

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APPENDIX 1

The merger simulation results with the assumption of Nash Bertrand conduct are presented in the following tables:

1) MARGINAL COSTS AND LERNER INDEX

Airline	OVERLAPPING MARKETS		
	Pre-merger Fare (USD)	Marginal cost (USD)	Lerner Index
American	317	232	0.299
Alaska	340	273	0.257
JetBlue	242	165	0.365
Delta	386	302	0.260
Frontier	115	42	0.713
Spirit	135	63	0.615
SkyWest	315	255	0.235
United	352	274	0.260
SouthWest	259	166	0.390
Others	268	202	0.323

Airline	NON-OVERLAPPING MARKETS		
	Pre-merger Fare (USD)	Marginal cost (USD)	Lerner Index
American	308	227	0.289
Alaska	299	221	0.319
JetBlue	217	140	0.409
Delta	348	270	0.260
Frontier	109	43	0.687
Spirit	121	52	0.663
SkyWest	300	235	0.264
United	328	251	0.270
SouthWest	254	144	0.473
Others	265	191	0.371

Lerner index values are lower in case of Bertrand competition since airlines do not set prices cooperatively. Frontier and Spirit still have the highest Lerner index values, indicating their ability to set prices above marginal costs.

2) PRICE CHANGES

Airline	OVERLAPPING MARKETS		
	Pre-merger Fare (USD)	**Post-merger Fare (USD)**	**Percent change**
American	317	317	0.0
Alaska	340	340	0.0
JetBlue	242	252	5.3
Delta	386	389	0.0
Frontier	115	119	0.1
Spirit	135	145	9.2
SkyWest	315	319	0.0
United	352	355	0.0
SouthWest	259	261	0.1
Others	268	271	0.0
Total passengers	12,477,715		
Passenger weighted average	1.31%		

Predicted price increases in overlapping markets are similar for Spirit and JetBlue as under partial collusion, but the change for other carriers are almost negligible, likely owing to no coordination and the assumptions of standard merger simulations (no change in products and product characteristics post-merger).