Examining the Coordinated Effects of the AA/USAir Merger

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Abstract

This paper studies the coordinated effects of the merger between American Airlines and US Airways by examining the extent to which the connecting prices of nonmerging legacy carriers (e.g., Delta Air Lines or United Airlines) evolved when the merger eliminated Advantage Fares, a connecting flight price discounting program offered by US Airways. In our empirical analysis, we find that postmerger nonmerging legacy carriers substantially increased their connecting prices on routes where US Airways had a dominant position. We claim that this unique connecting price pattern around the American/US Airways merger can be associated with the coordinated effects of the merger by ruling out several plausible possibilities. From our theoretical analysis, we show that merger-induced changes in cost structure can explain an incentive to collude of nonmerging carriers. Finally, we note the potential importance of connecting services in a merger review process, which was previously paid less attention to.

Keywords: Airline Mergers, Merger Analysis, Coordinated Effects
JEL Classification Numbers: L93, L41, L44

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1 Introduction

Competitive authorities investigate anticompetitive effects in markets when evaluating proposed mergers. The anticompetitive effects of mergers arise from the elimination of competition between merging entities, which increases their market power; this is referred to as the unilateral effect of mergers. Mergers can also diminish market competition by facilitating coordinated conduct among merging and nonmerging firms; this is referred to as the coordinated effect of mergers. In merger evaluations, whereas the authorities have a formal quantitative procedure to examine unilateral effects via merger simulation or upward pricing pressure tests, there is no systematic procedure for evaluating coordinated effects, largely because there are many types of collusive behavior; therefore, the effects are reviewed on a case-by-case basis (Porter (2020); Miller and Weinberg (2017); Greenfield et al. (2019)).

A merger's coordinated effects become more relevant when it involves a firm that plays a disruptive role in a market to the benefit of customers. Because these so-called maverick firms typically foster competition and obstruct collusive conduct among established firms in concentrated markets, there is a substantial concern that a merger eliminating a maverick firm could increase coordinated interaction among incumbents postmerger (Horizontal Merger Guidelines (Department of Justice) (2010)). Although this concern regarding coordinated effects has been shown in a wide range of high-profile merger cases (ABI/Modelo, H&R Block-TaxACT, T-Mobile/Sprint, American Airlines/US Airways), the academic literature tends to focus more on the unilateral effects, which can be examined with standardized quantitative approaches.

In this paper, we examine the coordinated effects of the merger between American Airlines (AA) and US Airways ($USAir$) in 2013 by examining the price and passenger share of nonmerging legacy carriers—Delta Air Lines (DL) and United Airlines (UA). As described in Fabra and Motta (2018), coordinated effects of a merger indicate either a higher probability that firms reach a collusive outcome by raising prices postmerger or a stronger collusive outcome by making collusion more sustainable. Related to their description, we begin by empirically examining the extent to which the connecting prices of nonmerging legacy carriers evolved when the merger absorbed $USAir$, which had disrupted incumbent carriers by providing consumers with a substantial connecting flight price discount program. Then, we theoretically investigate the latter aspect of the coordinated effects by comparing the nonmerging carrier's incentive to coordinate premerger with that postmerger. That is, we specifically investigate the coordinated effects on merger outsiders by focusing on price coordination between merging and nonmerging entities.

For our study, we focus on the AA/USAir merger case in the U.S. airline industry for the following two reasons. First, when the merger was proposed, there was substantial concern about the merger's coordinated effects. Prior to the AA/USAir merger, which was completed in December 2013, $USAir$ offered so-called Advantage Fares to price-sensitive passengers on its connecting routes, undercutting rivals' nonstop prices, especially for last-minute bookings. The underlying driving factor that allowed $USAir$ to implement the price discount program was that its hubs, located in Charlotte, Philadelphia, Phoenix, and Washington D.C., generate less revenue from nonstop services because they have lower traffic than the hubs of other legacy carriers. As Department of Justice. (2013) (DOJ) explains, $USAir$'s pricing strategy diverged from industry norms, whereby a legacy carrier would respect a rival legacy carrier's nonstop pricing on the rival's dominant route by not aggressively pricing its own connecting service on that route. Carriers did so in hopes that rivals would adopt the same strategy with respect to their dominant nonstop routes. The DOJ claimed that in response to $USAir$'s disruptive pricing strategy, three other legacy rivals—AA, DL, and UA (hereinafter, the *Major3*)—also discounted their connecting flight prices on routes where $USAir$ offered nonstop service, leading to intense price competition between $USAir$ and those legacy carriers across multiple routes. Merger opponents argued that the merger would deter such aggressive discounting and facilitate collusive conduct among merging and nonmerging legacy carriers, as the merger would eliminate the $USAir$'s Advantage Fares.

The second reason that we focus on this merger is that the U.S. airline industry has several features that, according to economic theory, could facilitate coordinated conduct. First, in theory, collusion is more sustainable when there are fewer participants. In the U.S. airline industry, a series of mergers in recent decades have made the industry more concentrated, with fewer carriers. Second, carriers can easily monitor the pricing and seat availability of their rivals in nearly real time. This price and capacity transparency can facilitate collusion, making the airline industry vulnerable to coordinated conduct (Department of Justice. (1993); Horizontal Merger Guidelines (Department of Justice) (2010); Porter (2020)). Last, carriers concomitantly operate services in a number of markets, leading to considerable multimarket contact, and there is an extensive understanding in the literature that multimarket contact can facilitate collusive behavior (Berheim and Whinston (1990); Evans and Kessides (1994); Ciliberto and Williams (2014); Porter (2020)).[1]

We first document that around the AA/USAir merger, the connecting service prices of nonmerging legacy carriers (e.g., DL and UA) dramatically changed on routes where $USAir$ had a dominant

[1]These industry features are potentially related to the fairly recent allegations regarding the industry's "capacity discipline": carriers have limited the growth of seat availability gradually over time and increased prices.

position. Using a difference-in-differences analysis, we find that premerger the 90th percentile price of connecting services offered by the nonmerging legacy carriers, a proxy for tickets transacted at the last minute, was substantially lower on routes where $USAir$ was the only carrier offering consistent nonstop service than on routes where one of the three legacy carriers—AA, DL or UA—was a dominant nonstop carrier. However, after the merger, the nonmerging legacy carriers' connecting prices on $USAir$'s nonstop route substantially increased relative to other route groups (e.g., decreased by more than 20% relative to one of the three legacy carriers' dominant nonstop routes). We also document a similar price change for the merging carriers' connecting flights on DL or UA's nonstop dominant route, reflecting intense competition with the existence of Advantage Fares premerger and soft competition postmerger.

We claim that this unique connecting price pattern around the AA/USAir merger can be associated with the coordinated effects of the merger by ruling out several plausible possibilities. For example, the widely adopted presumption in the literature maintains that the greater the changes in market concentration postmerger, measured by the Herfindahl-Hirschman Index (HHI), the greater the merger's unilateral effects will be. However, most routes that we analyze in the paper have minimal premerger overlap among merging carriers, leading to a negligible increase in HHI postmerger; thus, the unilateral effects are limited in our setting. Additionally, we find that our results are robust when we include year-route fixed effects to absorb time-varying route-specific unobservable demand/supply shocks that could be a confounding factor for our result. Our empirical results are also robust to a wide range of alternative specifications that address several concerns—(i) excluding routes associated with slot-constrained airports, (ii) using connecting services that survived throughout the sample period, and (iii) using a different definition of a route with dominant nonstop carriers.

We then develop an intuitive theoretical model with three airlines (AA, DL, and $USAir$) that operate in three different markets to characterize the conditions under which the identified empirical patterns can emerge. To better analyze the coordinated effects of a merger, we compare the sustainability of coordination for the nonmerging entity, DL, before and after the AA/USAir merger by considering a repeated game in an infinite time horizon, as in Igami and Sugaya (2021). Additionally, to emphasize the difference between $USAir$ and other legacy carriers, we consider cost asymmetry across firms by assuming that $USAir$ faces a cost advantage (disadvantage) on its connecting (nonstop) routes relative to other legacy carriers, which is the basis for its disruptive pricing strategy. After the AA/USAir merger, the merged entity becomes cost efficient in that AA obtained a cost advantage on its connecting routes while $USAir$ benefitted from a similar cost efficiency on its nonstop routes.

Here, we show that the AA/USAir merger makes coordination more sustainable for the non-

merging entity, DL, and that such coordinated effects are attributable to merger-driven changes in cost asymmetry. Specifically, these merger-driven coordination effects arise from *deviation-mitigating effects* (i.e., the nonmerging entity is less likely to deviate postmerger)—postmerger deviation is relatively less profitable than collusion given that the merged entity becomes a low-cost rival under its merger-induced efficiency gains, which increases DL's postmerger incentive to coordinate.

We conclude by remarking on the importance of connecting flights in airline merger analysis and on the AA/USAir merger's realized remedies. Airline merger analysis focuses primarily on a set of routes where the merging carriers represent a nonstop duopoly. On the other hand, connecting flights are considered a low-quality product with limited ability to constrain market power; hence, connecting flights have been of second-order importance in merger analysis. Whereas nonstop duopoly routes present substantial anticompetitive concerns, their passenger share is very small (e.g., 1% of domestic passengers on AA/USAir nonstop duopoly routes). In contrast, given that a substantial number of connecting passengers are on the routes affected by the elimination of Advantage Fares following the AA/USAir merger (e.g., 6.5% of domestic passengers), the aggregate loss in consumer surplus due to connecting flight price increases on those routes may be substantial enough to raise anticompetitive concerns. This suggests that it is crucial to consider potential consumer harm originating from a merger's coordinated effects over a wider range of routes rather than focusing on a few sets of local routes in airline merger analysis; such considerations will be directly related to the shape of merger remedies. In the AA/USAir merger case, the merger was approved with a set of remedies that would address the concerns related only to the unilateral effects of the merger. However, if the aggregated consumer harm from the merger's coordinated effects is high enough, actions to reduce such harm can be justified even if the actions may be costly (as in the case of, e.g., behavioral remedies with high monitoring costs).

Literature review This paper is related to the literature on the coordinated effect of mergers. Porter (2020) notes that unlike unilateral effects, coordinated effects do not lend themselves to a standardized merger review procedure. Focusing on the Miller/Coors merger in the U.S. brewing industry, Miller and Weinberg (2017) find that postmerger prices are 6 to 8% higher than they would have been had the merger affected pricing through only unilateral effects and not coordinated effects. Miller et al. (2021) extend previous work by considering price leadership in the U.S. brewing industry to explain the coordinated effects of the Miller/Coors merger. Focusing on a merger in the Swedish analgesics market, Björnerstedt and Verboven (2016) show that partial coordination explains some of the price increase for nonmerging firms that did not face a marginal cost increase. Brito et al. (2018) propose an empirical structural methodology to quantify the coordinated effects of partial horizontal

acquisitions. Loertscher and Marx (2021) identify tradeoffs between unilateral and coordinated effects and show that whether a merger involving a maverick firm harms market competition via coordinated effects depends on market-specific aspects.

Our work is also related to antitrust issues in the U.S. airline industry. A series of mergers and acquisitions of airline carriers in recent decades has led to more concentrated markets, giving rise to a large body of literature on airline mergers (Ashenfelter et al. (2014); Li et al. (2021); Park (2020); Das (2019)). Specifically, several studies examine issues around collusive behavior in the industry. In terms of multimarket contact, Evans and Kessides (1994) find that more market contact is positively associated with airline ticket prices. Ciliberto and Williams (2014) build a structural model in which a conduct parameter is a function of carrier-pair multimarket contacts and explore to what extent the contacts facilitate tacit collusion among airlines. Other studies focus on capacity disciplines. Aryal et al. (2020) study the relationship of public communication via earnings calls with carrier capacity reduction. Hazel (2018) finds a negative relationship between airline capacity and average domestic revenue per available seat mile.

Our work contributes to the literature in several ways. First, to the best of our knowledge, this is the first study in the literature documenting an unusual price increase among nonmerging legacy carriers after the AA/USAir merger and showing that it can be theoretically explained by the coordinated effects of mergers. Turner (2022) also studies the coordinated effects of the AA/USAir merger with a structural approach and presents a theoretical model to explain how the merger facilitates collusion. One critical difference is that here, we place more emphasis on how the elimination of $USAir$ affects the nonmerging entity, DL. When we analyze the sustainability of coordination in Section 4, we focus on how DL's postmerger incentive to coordinate differs from the premerger incentive by adopting a nested logit model with an outside option to consider the degree of substitutability between firms. Conversely, Turner (2022) finds that the merger does not affect the nonmerging carrier's collusion incentives because his theoretical model does not allow demand substitution given his assumption that a firm with a cost advantage takes the whole market share. Another important difference arises from our cost-related assumptions, which rely on the fact that nonstop traffic for $USAir$ at its hub airports was not profitable, unlike the traffic on its connecting routes (e.g., Olley and Town (2018); Department of Justice. (2013)). In this sense, our study and that of Turner (2022), who focuses on how the merger facilitates collusion incentives for $USAir$ as a merging entity by changing the network structure across the markets, complement each other.

In addition, we emphasize that connecting flights, which have been overlooked in the existing framework, can play a crucial role in airline merger reviews. By doing so, we provide relevant policy

implications in that connecting services can be used to deter competition among rivals across different markets, and anticompetitive effects may be understated if the role of connecting services is overlooked.

The rest of this paper is organized as follows. Section 2 describes the institutional background for the Advantage Fares and the AA/USAir merger. Section 3 describes the empirical analysis and is followed by Section 4, in which we introduce a theoretical model to examine the conditions under which a merger softens price competition via coordinated effects. Section 5 discusses several important aspects of our approach along with the relevant policy implications, and finally, Section 6 concludes the paper.

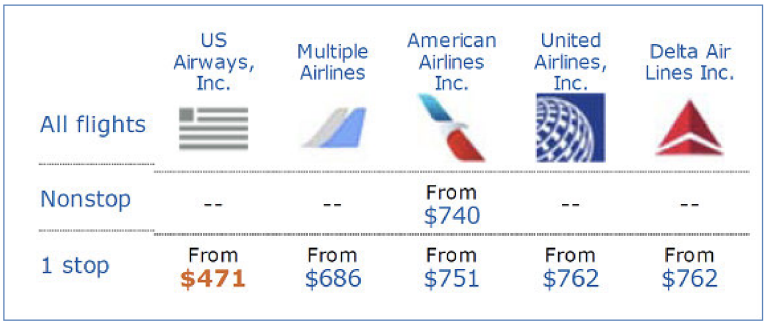
2 Institutional Background

In this section, we discuss the Advantage Fares employed by $USAir$ and the anticompetitive concerns around the AA/USAir merger by focusing on the merger's alleged coordinated effects.

2.1 Advantage Fares

Prior to the AA/USAir merger, $USAir$ had adopted the Advantage Fares strategy, providing cheap connecting services and undercutting other legacy carrier's nonstop fares, with price-sensitive passengers making last-minute bookings being the strategy's main target. This pricing strategy employed by $USAir$ was considered outside the industry norm, whereby legacy carriers (i.e., American Airlines, Delta Air Lines, and United Airlines) would respect their rivals' dominance on nonstop routes by offering connecting services at approximately the same price as the rival's nonstop service. $USAir$ did not seem to follow this so called *cross-market initiative* and adopted its aggressive discounting strategy largely because nonstop traffic at its hub airports was not particularly lucrative, and the carrier needed to increase its revenue stream (Department of Justice. (2013)).

Figure 1 shows an example of Advantage Fares premerger in the context of the *cross-market initiative*. Figure 1a shows the flight ticket options on the Miami to Cincinnati route one day before the departure date in August 2013. On this route where AA was the only nonstop carrier, $USAir$ substantially undercut AA's nonstop fare with its connecting service fare, inviting possible intense competition across markets. DL and UA, however, listed connecting flight prices similar to the nonstop fare offered by AA, seemingly respecting AA's dominant route. It appears that other legacy carriers responded to $USAir$'s Advantage Fares in a tit-for-tat fashion on $USAir$'s dominant routes. For example, Figure 1b shows that DL and UA offered connecting services at a price that substantially undercut $USAir$'s nonstop fare ($685) for the Charlotte to Syracuse route where $USAir$ was the only



(a) Miami to Cincinnati Route

(b) Charlotte to Syracuse Route

Note: The screenshots above are taken from the Department of Justice's complaint on the AA/USAir merger Department of Justice. (2013).

Figure 1: Connecting Flights on August 13, 2013 (screenshot taken on August 12, 2013)

dominant nonstop carrier. While Figure 1 shows only two cases, we can easily identify several similar examples in the data that we use for our empirical analysis, and it is clear that the Advantage Fares triggered intense competition among major carriers with connecting flight services across routes, and the elimination of the fare due to the AA/USAir merger led to an alarming anticompetitive concern.

2.2 AA/USAir Merger and Elimination of Advantage Fares

While there was substantial concern regarding the elimination of the Advantage Fares from the AA/USAir merger, the merger was approved without properly addressing anticompetitive concerns. According to Department of Justice. (2013), one of the main anticompetitive concerns regarding the AA/USAir merger was that the merger would eliminate *USAir*'s Advantage Fares, and that would facilitate postmerger collusive behaviors among major legacy carriers, as the merged firm that would absorb *USAir* would have no incentive to compete aggressively with other carriers. However, in the process of approving the merger, while a substantial discussion and analysis had been made regarding ways to address the merger's unilateral effects, especially for those routes where *AA* and *USAir* competed head-to-head on nonstop services, concerns over the elimination of Advantage Fares were not properly addressed. For example, the merger was approved with a set of remedies that address

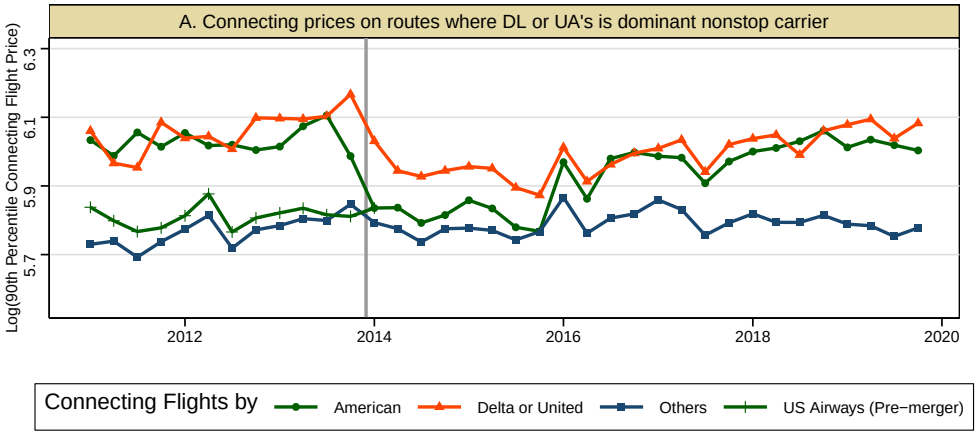
the concerns related only to the unilateral effects of the merger, through structural remedies requiring the merged firm to divest some of its slots/gates to other low-cost carriers. Given this background, it appears important to explore to what extent the elimination of the Advantage Fares triggered by the AA/USAir merger affected the competitive landscape. A more important question is whether the removal of the $USAir$'s discounted fares would facilitate collusive behavior among legacy carriers.

To better understand the merger's potential coordinated effects, in Figure 2, we plot the 90th percentile connecting flight prices over time on select groups of routes. We emphasize that these prices are the 90th percentile among all connecting ticket prices that a carrier offers on a route because connecting tickets sold at the last minute tend to be at the higher end of the price distribution of all purchased connecting tickets. Hence, these data can serve as an appropriate proxy for last-minute booking prices that capture the price competition with $USAir$'s Advantage Fares.

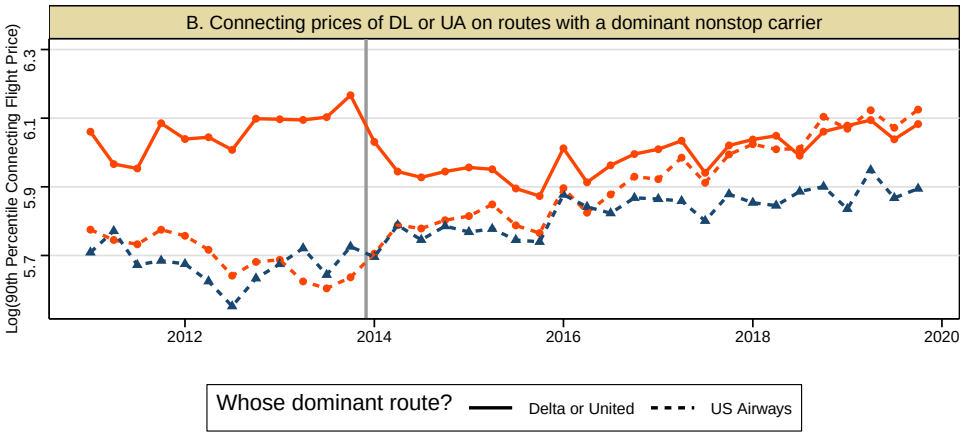
Figure 2a shows that connecting prices of the three legacy carriers (i.e., AA, DL, and UA) on routes where DL or UA was a dominant nonstop carrier premerger (hereinafter, *[DL or UA's NS Route]*) were substantially higher than $USAir$'s connecting prices on the same route group. After the AA/USAir merger (the vertical gray line indicates the completion date of the AA/USAir merger), however, we see that the connecting prices offered by the merged entity tend to converge to those of what DL or UA offered on *[DL or UA's NS Route]*. Note that the figure is descriptive and does not control for product- or route-specific characteristics that could be reflected in the price gap, such as distance flown. For this figure, however, the set of routes in each route group is fixed for the entire sample period to minimize the effects of route entries/exits on prices.

The data indicate that nonmerging legacy carriers were pricing aggressively on routes where $USAir$ was the dominant nonstop carrier (hereinafter, *[USAir's NS Route]*). Figure 2b shows that DL or UA's premerger connecting prices on *[USAir's NS Route]*, marked with the red dashed line, were approximately 20% lower than their prices on *[DL or UA's NS Route]*, marked with the red solid line. The nonmerging carriers' connecting prices on that route group are quite low, as they are comparable to the connecting prices offered by other carriers (including Southwest, JetBlue, and Alaska) on *[USAir's NS Route]*. However, the postmerger connecting prices offered by the nonmerging legacy carriers in the two route groups increase and converge with each other, which is similar to Figure 2a. This price increase seems unique to the legacy carriers, since the connecting flight prices offered by other nonmerging carriers tend to be flat or increasing with a lower growth rate over time.

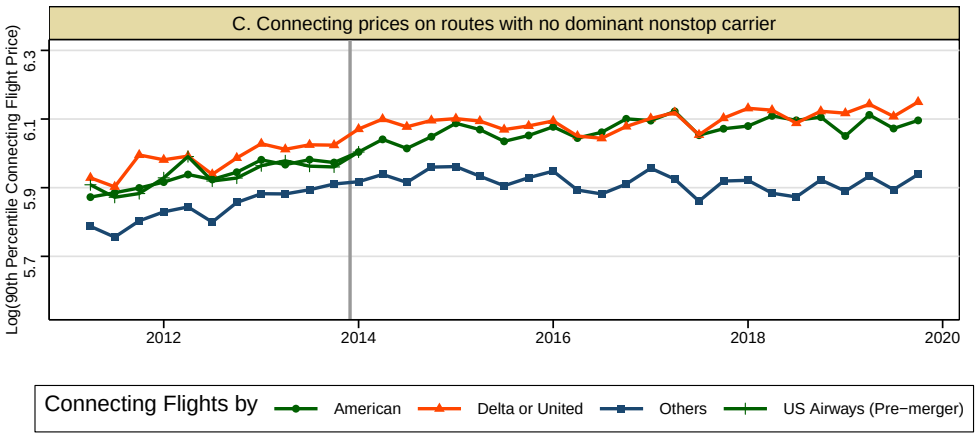
Finally, on routes where no airline is the dominant nonstop carrier, we do not find premerger price differences between $USAir$ and three legacy carriers. Figure 2c tracks of connecting prices over time among carriers on routes where no airline is the dominant nonstop carrier (hereinafter, *[Nobody's NS*



(a) On *[DL or UA's NS Route]*



(b) DL or UA's connecting prices



(c) On *[Nobody's NS Route]*

Note: The figure shows the (log-transformed) weighted average of the 90th percentile connecting prices of different carriers in different route groups (weighted by the number of passengers). A solid line refers to connecting prices on *[DL or UA's NS Route]*—routes where *DL* or *UA* was the only consistent nonstop service provider premerger, while a dashed-line refers to connecting prices on *[USAir's NS Route]*—routes where *USAir* was the only consistent nonstop provider premerger.

Figure 2: Connecting Flight Prices in Select Route Groups

Route]). The figure suggests that there is no substantial premerger price differences among DL, UA, AA and $USAir$, and the merger did not seem to change their pricing patterns distinctively. Overall, Figure 2 indicates that there exists a unique pricing pattern between legacy carriers and $USAir$ on routes where one of those carriers has a dominant position. The figure also indicates a substantial price increase postmerger on those routes, which may be attributable to both unilateral and coordinated effects, although we later claim that the unilateral effects are limited for the group of routes that we analyze.

Motivated by Figure 2, in Section 3, we further analyze the empirical patterns by performing a retrospective merger analysis with a difference-in-differences regression approach. Our regression results rule out several possibilities that the unique pricing pattern in Figure 2 is not due to the coordinated effects of the AA/USAir merger.

3 Empirical Analysis

In this section, we perform a regression analysis to explore the possibility of the coordinated effects of the AA/USAir merger. To do so, we first examine the data used for the analysis and then discuss the econometric method and regression results.

3.1 Data

For this analysis, we mainly use the Airline Origin and Destination Survey (DB1B), a publicly available dataset from the U.S. Department of Transportation. The DB1B contains a 10% sample of all air travel passenger itineraries in the U.S. domestic airline industry. This quarterly dataset includes information on origin, destination, and connecting (for itineraries with multiple connections) airports, ticket prices, passenger numbers, flight distances, and the carriers that ticket and operate the itineraries. Additionally, we use the Air Carrier Statistics (T-100), which contain monthly flight-level information on the numbers of flights, available seats, and passengers served by carriers on a given route. We match DB1B and T-100 to compute the flight frequency of nonstop flights. For the matching, the regional affiliates shown in T-100 are converted to their affiliated ticketing carriers in DB1B.

Following the literature (Ciliberto and Williams, 2014; Li et al., 2021), we define an airline market as a directional airport pair. This implies that one direction of an airport pair and the opposite direction of the same pair are different markets. Our dataset spans from the first quarter of 2011 to the last quarter of 2019, reasonably capturing airline products and markets before and after the 2013

AA/USAir merger. We drop itineraries with prices below $12.5 or higher than $1,250, as these prices are likely due to coding errors. In regard to itineraries including connections, we consider those with up to one connection because those with multiple connections are rare in the data (accounting for less than 1% of total U.S. domestic passengers). However, it is common practice for carriers to offer multiple itinerary options in a market via different connecting airports (e.g., $USAir$'s connecting flight from Boston to Miami via Washington D.C. or Philadelphia). In this sense, we group any multiple itineraries offered by the same carrier in a market into a single connecting product because the prices of these itineraries are similar and our focus is on the carrier's overall connecting traffic on a route around the time of the merger rather than on the carrier's connecting traffic substitution among its individual hub airports.

Route Group We divide routes into several groups depending on which carrier offers solely nonstop services premerger. Let $g \in \{USAir, Major3, Southwest, Other\}$ be a carrier group, where $Major3 = \{DL, UA, AA\}$, and $Other$ includes all the other carriers except $Major3$, $USAir$, and $Southwest$. We define route m as g's nonstop route (*[g's NS Route]*) if one of the carrier members in g is the only carrier offering at least daily nonstop flights on route m for twelve consecutive quarters before the AA/USAir merger.

For example, the route from Philadelphia (PHL) to Austin (AUS) is a *[USAir's NS Route]* because $USAir$ was the only nonstop carrier from 2011Q1 to 2013Q4 with more than one flight per day, while other carriers on the route either partially provided nonstop flights or offered connecting services only. Similarly, route m is a *[Major3's NS Route]* if the dominant nonstop carrier on the route is AA, DL, or UA and is a *[Southwest's NS Route]* if the dominant nonstop carrier is Southwest. Route m is an *[Others' NS Route]* if the only nonstop carrier on m is one other than the *Major3*, $USAir$ or *Southwest*. Carriers in this *Other* route group include Alaska Airlines, JetBlue, Frontier, Spirit, and Virgin America, which are mostly low-cost carriers. Last, route m is defined as *[Nobody's NS Route]* if there is no carrier consistently offering nonstop flights in m. We use *[Nobody's NS Route]* as a reference group for our empirical analysis, as carriers on those routes have small or limited incentives to respond to Advantage Fares.

Note that we classify the route group based on consistent nonstop service offered ***before*** the AA/USAir merger so that we can track the extent to which the merger led to distinct price changes among nonmerging legacy carriers—DL and UA—on *[USAir's NS Route]* relative to price changes in other route groups (e.g., *[Major3's NS Route]* or *[Nobody's NS Route]*). Note further that dominant nonstop carriers on a route defined above have either the origin or destination airport of the route at their hub airport. For example, routes on *[USAir's NS Route]* include Charlotte (CLT), Philadelphia

Table 1: Summary Statistics of Connecting Flights Offered by DL or UA

		Whose Nonstop Routes?				
Variable	Statistics	Major3	USAir	Southwest	Other	Nobody
Panel A. Pre-Merger (2011Q1-2013Q4)						
N. Passengers	Mean	541.89	1,188.24	1,116.99	1,519.34	745.80
	Std. Dev.	506.30	1,245.40	1,103.34	1,692.72	679.24
Ticket Price (U.S. dollar)	Mean	243.84	196.86	191.65	215.40	250.79
	Std. Dev.	53.86	47.14	35.51	49.21	56.83
Distance (1,000 miles)	Mean	1.41	1.32	1.38	1.94	1.60
	Std. Dev.	0.55	0.72	0.53	0.72	0.64
Observations		10,774.00	4,245.00	7,531.00	2,213.00	96,454.00
Panel B. Post-Merger (2014Q1-2019Q4)						
N. Passengers	Mean	695.14	976.46	921.55	1,498.08	729.06
	Std. Dev.	668.26	1,110.56	823.34	1,448.90	634.96
Ticket Price (U.S. dollar)	Mean	245.64	233.79	230.01	233.19	281.48
	Std. Dev.	50.56	50.00	46.42	54.27	56.25
Distance (1,000 miles)	Mean	1.43	1.40	1.31	1.86	1.59
	Std. Dev.	0.57	0.75	0.52	0.72	0.65
Observations		24,033.00	7,820.00	14,638.00	4,503.00	194,167.00
Panel C. Route-level HHI						
Post-merger HHI	Mean	6,491.47	6,512.25	7,513.55	6,079.96	4,705.17
	Std. Dev.	1,724.94	1,933.75	2,002.73	2,369.63	1,552.67
Δ HHI	Mean	241.08	151.02	15.24	33.70	141.17
	Std. Dev.	585.82	335.15	34.68	107.85	381.62
Number of unique routes	NA	1,007.00	252.00	458.00	128.00	6,461.00

Note: 'Major3' column refers to *Major3's NS Route*—a set of routes in which one of three legacy carriers, AA, DL, and UA, was the only carrier offering at least daily nonstop service from 2011Q1 to 2013Q4. Analogously, the 'USAir', 'Southwest', 'Other' and 'Nobody' columns refer to *USAir's NS Route*, *Southwest's NS Route*, *Others' NS Route*, and *Nobody's NS Route*, respectively.

(PHL), Phoenix (PHX), or Washington Reagan National (DCA) as one of the two end points of a route as they are $USAir$'s hub airports.

Summary Statistics Panels A and B of Table 1 show the summary statistics of connecting flights offered by nonmerging legacy carriers DL or UA on the different types of nonstop route groups. The table indicates that the average number of connecting passengers served by DL or UA premerger is 542 on *[Major3's NS Route]*, which is less than the half of the average passenger levels on other route groups that have dominant carriers. This would reflect that DL or UA's connecting services are not very attractive to passengers particularly on *[Major3's NS Route]* given their high prices. After the AA/USAir merger, DL's or UA's connecting passenger level, on average, increased by 28% on *[Major3's NS Route]* but decreased by 17% on *[USAir's NS Route]* and *[Southwest's NS Route]*. The average premerger price is the highest on *[Major3's NS Route]* ($243.8), followed by that on the *[Others' NS Route]* ($215.4), *[USAir's NS Route]* ($196.8), and *[Southwest's NS Route]* ($191.6). The average distance of a connecting flight ranges from 1,300 to 1,900 miles across different route groups. Panel C in Table 1 shows the postmerger Herfindahl-Hirschman Index (HHI) and its change from

premerger HHI (ΔHHI). As expected, the routes with dominant carriers tend to be concentrated, having a higher level of post-merger HHI. The average ΔHHI, however, seems low across route groups, ranging from 15 to 240. While the highest average ΔHHI appears on *[Major3's NS Route]* mostly due to AA's dominant nonstop routes (*[AA's NS Route]*) where both merging carriers operated, flights on *[AA's NS Route]* are excluded from our main analysis.

3.2 Econometrics Methods

3.2.1 Connecting Flights Offered by Nonmerging Legacy Carriers

We first focus on the connecting flights of nonmerging legacy carriers—DL or UA.[2] Premerger, if the nonmerging legacy carriers set more aggressive prices on *[USAir's NS Route]* in response to $USAir$'s Advantage Fares, we would expect that their connecting prices on that route were substantially lower than those on *[Major3's NS Route]* or on *[Nobody's NS Route]*. If coordinated effects existed for the AA/USAir merger, the elimination of Advantage Fares postmerger would give nonmerging carriers incentives to soften competition and that would be reflected in the data. To examine this, we employ a difference-in-differences regression analysis with the following model by considering only those connecting flights offered by DL or UA on the five nonstop route groups that we defined above—*[Major3's NS Route]*, *[USAir's NS Route]*, *[Southwest's NS Route]*, *[Others' NS Route]*, and *[Nobody's NS Route]*):

$$y_{imt} = \sum_{g \in G} \beta_{1,g} \mathbb{1}[g'\text{s NS Route}]_m + \sum_{g \in G} \beta_{2,g} \mathbb{1}[\text{Post}]_t \times \mathbb{1}[g'\text{s NS Route}]_m + X_{imt}\gamma + \tau_t + \eta_{t'm} + \epsilon_{imt}, \quad (1)$$

where subscript i is for carrier, m is for market, and t is for time (year-quarter). $\mathbb{1}[g'\text{s NS Route}]_m$ is an indicator variable for carrier group g that takes value 1 if route m is g's nonstop route premerger and 0 otherwise, for $g \in G$ where $G = \{Major3, USAir, Southwest, Others, Nobody\}$. We include year-route fixed effects ($\eta_{t'm}$ where subscript t' is for year) to absorb yearly varying route-level heterogenous demand or cost shocks. We also include time fixed effects τ_t to absorb time-varying unobservables, which prevents the inclusion of the postmerger indicator in the model. X_{imt} contains a vector of

[2] If a dominant nonstop carrier offers both nonstop and connecting services, we do not include the connecting service from the dominant carrier in our analysis. For example, we include DL's connecting service on *[Major3's NS Route]* if UA is a dominant nonstop carrier on a route. However, we do not include DL's connecting service on *[Major3's NS Route]* if DL is a dominant nonstop carrier on a route.

observable product characteristics, including travel distance and airport presence.[3] In X_{imt}, we also include the number of low-cost legacy carriers to capture changes in the postmerger market structure of those routes predefined based on the premerger market structure.

Table 2: Regression Result: Connecting Flights Offered by Delta or United

	log(90th price)				log(avg price)	log(passengers)
	(1)	(2)	(3)	(4)	(5)	(6)
[USAir's NS Route]	-0.241***	-0.154***	-0.173***	-0.151***	-0.139***	0.297**
	(0.041)	(0.038)	(0.029)	(0.038)	(0.030)	(0.132)
[Post] × [USAir's NS Route]	0.222***	0.135***	0.170***	0.077**	0.097**	-0.218***
	(0.041)	(0.039)	(0.025)	(0.035)	(0.038)	(0.043)
[Major3's NS Route]		0.091***	0.095***	0.093***	0.032**	-0.148***
		(0.016)	(0.013)	(0.016)	(0.014)	(0.049)
[Post] × [Major3's NS Route]		-0.109***	-0.116***	-0.139***	-0.084***	0.193***
		(0.013)	(0.007)	(0.012)	(0.011)	(0.041)
R^2	0.562	0.529	0.440	0.535	0.619	0.420
Observations	58,095	286,313	286,313	366,366	286,313	286,313
Excluding 2014-2015 obs?	Yes	Yes	Yes	No	Yes	Yes
Control Group (whose NS Route?)	Major3's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time and Route fixed effects	✓	✓	✓	✓	✓	✓
Year-Route fixed effects	✓	✓		✓	✓	✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by Delta or United. 'Excluding 2014-2015 obs?" indicates whether the sample excludes the observations of year 2014 and 2015. 'Control Group (whose NS Route?)' indicates which nonstop route group is served as an ommitted reference group. Standard errors are in the parenthesis and clustered at the route-level. The full regression results can be found in Table A1.

Table 2 presents the key regression results from Equation (1), and its full regression result can be found in Table A1 in Appendix A. Column (1) indicates that premerger the 90th percentile price of the nonmerging legacy carriers on *[USAir's NS Route]* was 27.3%[4] lower, but the price increased by 24.9% postmerger, relative to that on *[Major3's NS Route]*. In columns (2)-(6), the connecting flights of DL or UA on *[Nobody's NS route]* are included and serve as a reference group. Column (2) shows that relative to the reference group, nonmerging carriers' prices are 9.5% higher on *[Major3's NS Route]* but 16.6% lower on *[USAir's NS Route]* premerger. These price differences are consistent with the alleged *cross-market initiative*. Postmerger prices decreased (increased) on *[Major3's NS Route]* (*[USAir's NS Route]*), making the connecting flights have similar prices across routes after the merger was completed. The result holds when we do not include the year-route fixed effects in column (3).

[3]The airport presence of a carrier is defined as the fraction of nonstop destinations offered by the carrier out of the nonstop destinations offered by all carriers at the same airport.

[4]$e^{0.241} - 1 = 0.273$.

Note that we exclude observations of the first two years after the AA/USAir merger in our preferred specifications to avoid any temporary shifts due to the merger such as the merged carrier's system integration; however, the qualitative result holds when including the observations for 2014 and 2015 as shown in column (4). In column (5), where we use the average prices as a dependent variable, which can be viewed as a weaker proxy for measuring last-minute bookings, the estimation results are similar to those using the 90th percentile prices, although the magnitude and statistical power are reduced. Finally, column (6) shows that there were more connecting passengers taking nonmerging carriers' flights on *[USAir's NS Route]* premerger, but postmerger it decreased by 24.4%, which mainly reflects a demand response to a price increase.

While the data clearly show distinctive connecting price patterns of nonmerging carriers on *[USAir's NS Route]* and *[Major3's NS Route]* around the AA/USAir merger, care should be taken before contending that the price patterns are associated with the coordinated effects of the merger. There may be, in large, two responses. One would argue that the price change that we witnessed may be due to factors not related to the AA/USAir merger, such as demand or supply shocks that affect routes locally. Alternatively, the price change may reflect the anticompetitive effects of the merger, but these can be purely unilateral or a combination of unilateral and coordinated effects of the merger. We address the first concern by adding a wide range of fixed effects to control for unobservables in various dimensions. Specifically, we include time (year-quarter) and route fixed effects to absorb shocks at any given time and to control for route-specific unobservables. In addition, we include year-route level fixed effects in the regression model to absorb route-specific demand or cost shocks that may vary yearly. We find that the results are robust regardless of whether we add the year-route fixed effects.

We argue that our empirical framework can mitigate the second concern about the role of unilateral effects. In general, it is empirically challenging to separate coordinated effects from unilateral effects. However, the set of routes that we consider in our empirical analysis contains minimal premerger overlaps for merging parties since we focus only on the routes directly affected by the elimination of Advantage Fares with one dominant nonstop carrier and a few carriers offering connecting flights. For example, the predicted changes in HHI (i.e., ΔHHI) for more than 65% of these routes are less than 50, while a ΔHHI greater than 200 is considered worthy of antitrust scrutiny for a merger review according to Horizontal Merger Guidelines (2010). If we take the widely used assumption in the literature that the price effects of mergers are proportional to ΔHHI (Miller and Weinberg, 2017; Dafny et al., 2012; Ashenfelter et al., 2014), there would be a considerable unilateral effect on those routes with a larger change in HHI.

On the contrary, we find that our results are the most prominent on the route group with the

smallest HHI change, suggesting that the unilateral effects are not the main driver of the price dynamics of nonmerging carriers on *[USAir's NS Route]*. Table 3 shows the regression results of Equation (1) with grouping routes based on ΔHHI and running the regression separately by each of those route groups. Table 3 indicates that the aggressive pricing pattern of nonmerging carriers for *[USAir's NS Route]* premerger, followed by a substantial price increase postmerger, is the most salient when we condition on those routes with ΔHHI less than 50 as in columns (1) and (2). For those routes with higher HHI changes (either $\Delta HHI = [50, 200)$ in columns (3) and (4) or $\Delta HHI = [200, \infty)$ in columns (5) and (6)), the price increase postmerger on *[USAir's NS Route]* is either statistically insignificant or smaller in magnitude.

Table 3: Regression Result: Connecting Flights Offered by Delta or United (Group by ΔHHI)

Premerger ΔHHI	log(90th price)					
	$\Delta HHI = [0, 50)$		$\Delta HHI = [50, 200)$		$\Delta HHI = [200, \infty)$	
	(1)	(2)	(3)	(4)	(5)	(6)
[USAir's NS Route]	-0.186***	-0.150***	-0.075	-0.045	-0.151***	-0.144***
	(0.026)	(0.029)	(0.072)	(0.102)	(0.034)	(0.048)
[Post] × [USAir's NS Route]	0.215***	0.149***	-0.002	-0.055	0.112***	0.098**
	(0.025)	(0.033)	(0.061)	(0.111)	(0.025)	(0.048)
[Major3's NS Route]	0.113***	0.102***	0.154***	0.160***	0.027	0.033
	(0.016)	(0.020)	(0.020)	(0.026)	(0.023)	(0.037)
[Post] × [Major3's NS Route]	-0.116***	-0.097***	-0.184***	-0.198***	-0.095***	-0.104***
	(0.009)	(0.017)	(0.015)	(0.026)	(0.013)	(0.038)
R^2	0.460	0.550	0.404	0.510	0.348	0.455
Observations	191,506	191,506	34,546	34,546	60,261	60,261
Control Group (whose NS Route?)	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time and Route fixed effects	✓	✓	✓	✓	✓	✓
Year-Route fixed effects		✓		✓		✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by DL or UA. The omitted reference route group is [Nobody's NS Route]. The sample period is between the first quarter of 2011 and the last quarter of 2019 excluding the year 2014 and 2015. Standard errors are in the parenthesis and clustered at the route-level. The full regression results are reported in Table A2.

3.2.2 Connecting Flights on Nonmerging Legacy Carriers' Nonstop Routes

It is natural to extend our analysis to examine the extent to which the connecting prices of the **merged carrier** differ on various nonstop route groups around the AA/USAir merger. To do so, we use the same regression model in Equation (1) but restrict our sample to any connecting flights offered

by *AA* or *USAir* in the aforementioned five nonstop route groups. For this analysis, instead of using all the routes from *[Major3's NS Route]*, we use *[DL or UA's NS Route]* that excludes *[AA's NS route]* from *[Major3's NS Route]* to minimize any confounding price effects coming from the AA/USAir merger on the merging firm's dominant route.

Table 4 reports the regression results for the sample of connecting flights offered by merging carriers, which are consistent with our prediction. Column (2) shows that the premerger prices of those merging carriers on *[DL or UA's NS Route]* are relatively lower (-6.4%) than those on the route where there are no dominant nonstop carriers, which is consistent with aggressive discounting of prices from Advantage Fares. The magnitude is estimated to be smaller than the -16.6% for nonmerging carriers' connecting flights on *[USAir's NS Route]* in column (2) of Table 2, as this would reflect aggressive pricing for only one of the two merging carriers (i.e., *USAir*) premerger. After the merger, however, their connecting prices on *[DL or UA's NS Route]* increased, making the prices similar to the level that they set on *[Nobody's NS Route]*. Note that the interaction term [Post] x [USAir's NS Route] is not identified because we exclude any connecting flights offered by a dominant nonstop carrier on a route and *USAir* becomes a merged entity on *[USAir's NS Route]* postmerger. Similar to Table 2, the results hold when we do not include year-route fixed effects in column (3), when the observations from year 2014 and 2015 are included in column (4), and when we switch to use the average connecting prices as a dependent variable in column (5), although the estimates have a smaller magnitude and lower statistical power. In column (6), we verify that the passenger level on *[DL or UA's NS Route]* substantially decreased postmerger.

3.2.3 Further Discussion and Robustness Check

Discussion The unique price patterns of connecting flights among legacy carriers do not seem to apply on *[Others' NS Route]*. For example, columns (2)-(6) of Table A1 in the Appendix indicate that the postmerger changes in the connecting prices of nonmerging carriers on *[Others' NS Route]* do not differ from those on *[Nobody's NS Route]*. However, the table shows that the connecting prices of nonmerging legacy carriers evolved in a similar way on both *[USAir's NS Route]* and *[Southwest's NS Route]*. These findings naturally raise a question of whether there is any sort of possible coordination among *Southwest* and the three legacy carriers. In a 2015 lawsuit, in fact, it was alleged that *Southwest* limited available seats and increased ticket prices with the three legacy carriers. While the carrier settled with members of a class-action lawsuit in 2018, *Southwest* denied that it had any unlawful agreements with *AA*, *DL*, or *UA* (Stevens, 2018). Future research should explore to what extent the role of the largest low-cost U.S. carrier in the country's airline market competition has

Table 4: Regression Result: Connecting Flights Offered by Merging Carriers

	log(90th price)				log(avg price)	log(passengers)
	(1)	(2)	(3)	(4)	(5)	(6)
[USAir's NS Route]		0.091***	0.088***	0.108***	0.075***	-0.583***
		(0.028)	(0.024)	(0.028)	(0.025)	(0.101)
[DL or UA's NS Route]	0.018	-0.066***	-0.071***	-0.067***	-0.025***	0.466***
	(0.034)	(0.011)	(0.013)	(0.011)	(0.009)	(0.064)
[Post] × [DL or UA's NS Route]	-0.059***	0.073***	0.080***	0.027***	0.004	-0.504***
	(0.016)	(0.012)	(0.008)	(0.009)	(0.013)	(0.061)
R^2	0.630	0.601	0.498	0.601	0.665	0.611
Observations	33,406	143,868	143,868	190,058	143,868	143,868
Excluding 2014-2015 obs?	Yes	Yes	Yes	No	Yes	Yes
Control Group (whose NS Route?)	USAir's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time and Route fixed effects	✓	✓	✓	✓	✓	✓
Year-Route fixed effects	✓	✓		✓	✓	✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by Delta or United. 'Excluding 2014-2015 obs?" indicates whether the sample excludes the observations of year 2014 and 2015. 'Control Group (whose NS Route?)' indicates which nonstop route group is served as an ommitted reference group. Standard errors are in the parenthesis and clustered at the route-level. The full regression results can be found in Table A3.

changed.

Robustness Check Our empirical results are robust to a series of different specifications, and Table A4 shows the robustness check results. First, there might be a concern that the structural remedies at slot-constrained airports with which the AA/USAir merger was approved could be a confounding factor. This is especially relevant given that *USAir* used Washington DC's Reagan National Airport, which is one of the slot-constrained airports, as one of its main hub airports before the merger. To address this concern, we exclude any routes from/to two slot constrained airports—Reagan National Airport (DCA) and New York La Guardia airport (LGA)—in which slot divestitures took place the most for this merger deal. We find that our empirical results are robust to this specification (the first panel in Table A4).

Second, an entry/exit of flight service during the sample period could drive the results. We address this concern by restricting the sample to those connecting flights that survived over the entire period (2011-2019). We find that our results are robust when we use a balanced panel (the second panel in Table A4).

Third, how we define a carrier's nonstop route could affect the regression results. While we focus on the routes such that only one carrier persistently offered nonstop services prior to the merger in the main analysis, we vary the threshold of the definition to consider 8 or 4 quarters instead of 12

quarters. Our results are robust to various definitions, as shown in the third and fourth panels in Table A4.

Last, we report the regression results when the average price is used as a dependent variable in Table A4. Although we believe that the 90th percentile prices will reflect the prices most affected by $USAir$'s Advantage Fares, there might be a concern that these prices do not represent general ticket prices. We find that the qualitative results with the average prices tend to be consistent with those using the 90th percentile prices.

4 Theoretical Model

As mentioned earlier, the coordinated effects of the merger indicate either a higher probability of firms reaching a collusive outcome by raising postmerger prices or a stronger collusive outcome by making collusion more stable. To examine the latter aspect of the coordinated effects from the nonmerging entity's perspective, we develop a theoretical model with an infinitely repeated Bertrand game. In addition, focusing on cost asymmetry among airlines, we theoretically show how the merger induces a change in the behavior of $USAir$ to address the underlying reasons why $USAir$ did not participate in coordination prior to the merger.

4.1 Primitives

Airlines A consumer in the unit mass chooses one airline from among three alternatives, denoted as AA, DL, and $USAir$. Thus, the set of alternatives conditional on flying is $\mathcal{F} = \{AA, DL, USAir\}$. The net utility arising from the outside option, i.e., not flying, denoted as $\mathcal{NF}$, is normalized to zero.

Markets There are three different markets, $m \in \mathcal{M}$, where $\mathcal{M} = \{1, 2, 3\}$, in which all three airlines operate. We assume that in each market, one of the airlines serves as a nonstop monopolist, while the remaining two carriers operate connecting flights. Specifically, we assume that DL in $m = 1$, $USAir$ in $m = 2$, and AA in $m = 3$ are nonstop monopolists in that market. This market structure reflects the earlier definition of a carrier's nonstop routes (e.g., *[USAir's NS Route]*). We also assume that the three markets have identical characteristics, such as origin/destination airport size and nonstop distance. Given this three-market/three-airline setup, we examine how the AA/USAir merger affects the competitive structure across markets. Specifically, our analysis allows us to see how nonmerging legacy carriers such as DL and merging entities AA and $USAir$ change their pricing behavior before and after the merger. The market structure is summarized in Figure 3.

Consumer Utility Specification Consider each market in which the three airlines compete

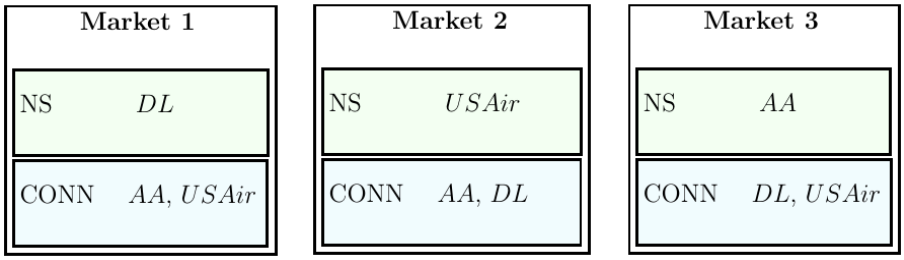


Figure 3: Market Structure

with each other. The indirect utility of a consumer who takes airline $j \in \mathcal{F}$ in market m is given as follows.

$$u_{jm} = \underbrace{\phi_{jm} + \alpha p_{jm} + \eta \times \mathbb{1}_{jm}^{CONN} + \xi_{jm}}_{\equiv V_{jm}} + (1-\sigma)\varepsilon_{jm}, \tag{1}$$

where $\mathbb{1}_{jm}^{CONN}$ is one if j offers a connecting flight service in market m and zero otherwise and $\eta \leq 0$ captures a passenger's disutility incurred from taking connecting flights, such as longer flight times. $\alpha \leq 0$ is the service-specific price sensitivity, p_{jm} is the airfare for j in market m, and ϕ_{jm} captures other observable service characteristics. Additionally, ξ_{jm} captures unobservable product quality, which we normalize to zero for all j in m, and ε_{jm} is an independent and identically distributed random unobserved component of consumer utility, which follows a Type I extreme value distribution. The parameter σ represents the degree of independence in unobserved utility among alternatives within a nest: the higher the value of σ is, the greater the differentiation between products in the same nest. That is, $1-\sigma$ measures the degree of substitution. For notational convenience, V_{jm} represents the quality of product j including its price.

A consumer chooses airline j over k if $u_{jm} > u_{km} \; \forall \; k \in \mathcal{F} \setminus j$. The choice probability of a consumer choosing airline j in market $m \in \mathcal{M}$ is given as follows.

$$\begin{aligned} x_{jm} &= \mathbb{P}_{jm|\mathcal{F}} \times \mathbb{P}_{\mathcal{F}} \\ &= \frac{\exp\left(\frac{V_{jm}}{1-\sigma}\right)}{\sum_{k\in\mathcal{F}} \exp\left(\frac{V_{km}}{1-\sigma}\right)} \times \frac{\left[\sum_{k\in\mathcal{F}} \exp\left(\frac{V_{km}}{1-\sigma}\right)\right]^{1-\sigma}}{1 + \left[\sum_{k\in\mathcal{F}} \exp\left(\frac{V_{km}}{1-\sigma}\right)\right]^{1-\sigma}}, \end{aligned} \tag{2}$$

where $\mathbb{P}_{jm|\mathcal{F}}$ is the conditional probability of choosing airline j given that a consumer takes a flight, and $\mathbb{P}_{\mathcal{F}}$ is the probability of choosing to fly over not flying.

Airline's Problem We consider an infinitely repeated Bertrand game with cost asymmetry.

Each airline j's per period profit is given as follows.

$$\pi_j = \sum_{m \in \mathcal{M}} (p_{jm} - c_{jm}) x_{jm}(\mathbf{p_m}), \tag{3}$$

where $\mathbf{p_m}$ is a vector of product prices in market m and c_{jm} is the marginal cost of operation for airline j in market m. To emphasize the airline's multimarket strategic choices, we allow each airline to maximize its aggregate profit across markets. That is, airline j chooses p_{j1}, p_{j2}, and p_{j3} by solving $\max_{p_{j1},p_{j2},p_{j3}} \pi_j$: this profit maximization allows airline j to cross-subsidize across markets.

Premerger, airlines collude by maximizing their joint profits until a deviation occurs: if any airline deviates at any given time t, all members adopt the punishment scheme. Given that $\mathcal{C}$ denotes the set of airlines that coordinate, the per period collusive profit for airline j is defined by $\Pi_j \equiv \pi_j + \mathbb{1}_{j,k \in \mathcal{C}} \sum_{k \neq j} \pi_k$. If j deviates from coordination with other carriers, it considers only its own multimarket profit without coordination, while other carriers in the set of $\mathcal{C}$ still take j's profit into consideration: the deviation profit for j is denoted as Π_j^d. Once any firm deviates, the game returns to that with individual profit maximization, i.e., Nash equilibrium, as a punishment: airline j's profit under punishment is denoted as Π_j^n. Future profits are discounted with a common discount factor δ. Intertemporal (collusive) profits can be represented by $\sum_{s=0}^{\infty} \delta^s \Pi_j$ for the premerger period and $\sum_{s=0}^{\infty} \delta^s \Pi_j^M$ for the postmerger period.

Merger Analysis We assume that AA is merged with $USAir$ while DL remains an independent airline. Postmerger, the merged entity maximizes the joint profit of AA and $USAir$ in each market. We do not endogenize AA's decision on whether to merge with any rival airline because we place more emphasis on how the merger affects the market's competitive structure, especially through its impact on nonmerging entity DL, taking the merger between AA and $USAir$ as given.

As shown in Sections 2 and 3, before the AA/USAir merger, major legacy carriers set relatively low connecting airfares, thereby capturing a greater market share, on *[USAir's NS Route]*, compared to their prices on *[Major3's NS Route]*. However, after the merger, this discrepancy in legacy carriers' relative pricing strategies disappeared, such that their connecting price ratios to $USAir$'s nonstop service price were no longer lower than those to other legacy carriers' nonstop service price. With respect to this finding, our concern is whether the AA/USAir merger eliminated intense competition, and we focus on the effects of mergers on nonmerging entities' incentive to coordinate, namely, mergers' coordinated effects.

Cost Structure Different carriers are likely to have different cost structures depending on their operation type (whether they offer nonstop or connecting flights) and carrier type (whether

they implement a disruptive pricing strategy). Given that the three markets are identical in terms of operation, e.g., the routes in the three markets have the same distance and airport taxes, operating in any market results in no difference in terms of operating costs, and the only cost difference comes from company-wise efficiency and types of services.

Let c_{jm} denote the cost of carrier j in market m. We assume that $USAir$ has company-specific cost advantages over its rivals in providing connecting services in markets 1 and 3, which allows the company to offer such competitive fares: as stated in Olley and Town (2018), $USAir$ had a competitive cost structure compared to that of its rivals. For example, given that $USAir$ and AA serve connecting services in $m = 1$, we assume that $\gamma\bar{c} \equiv c_{USAir1} \leq c_{AA1} \equiv \bar{c}$, where $\gamma \in [0, 1]$ represents the cost efficiency of $USAir$ in comparison to the costs of other legacy carriers in providing the same connecting services.

Additionally, the marginal cost of nonstop service is different from that of connecting service: DL's marginal cost of providing direct service in $m = 1$ is denoted as c_{DL1}, which is lower than the cost of providing connecting flights. This assumes that fuel costs are sufficiently high that offering connecting services, which consume more fuel than short direct services, incurs higher marginal costs.

For $m = 2$, we assume that AA and DL, which provide connecting services, incur the same marginal costs, i.e., $c_{DL2} = c_{AA2} \equiv \bar{c}$. Furthermore, the cost to $USAir$ of providing direct service in $m = 2$ is c_{USAir2}, where $c \equiv c_{USAir2} \geq c_{DL1} \equiv \underline{\gamma}c$, with $\underline{\gamma} \in [0, 1]$ being the cost inefficiency of $USAir$ relative to the costs of other legacy carriers in providing the same nonstop services. This asymmetric cost structure captures the fact that $USAir$ is disadvantaged in offering direct routes due to its less profitable hubs with low traffic volumes in comparison to DL's offer of direct service in a different market: in our framework, this lower profitability is represented by the higher cost incurred. In this sense, market 2 represents the cities with former $USAir$ hubs, such as Charlotte, whereas market 1 represents the cities with DL hubs, such as New York City (LaGuardia). However, such a market-specific difference does not necessarily mean that other legacy carriers offering connecting services in market 2 with low traffic suffer from less revenue: given that those connecting airlines have one or more stops between the origin and destination cities in market 2, their revenue sources are not limited to cities with low traffic. Thus, we assume that the marginal costs for connecting services provided by the legacy carriers, DL and AA, are symmetric as $c_{AA1} = c_{AA2} = c_{DL2} = c_{DL3} \equiv \bar{c}$.

In $m = 3$, DL and $USAir$ are connecting carriers (with $\gamma\bar{c} \equiv c_{USAir3} \leq c_{DL3} \equiv \bar{c}$), whereas AA is a nonstop carrier (with $\underline{\gamma}c \equiv c_{AA3} \leq c_{USAir2} \equiv c$). That is, even in market 3, $USAir$ has a comparative advantage over DL in providing connecting services. In summary, the cost structure that we consider is given as follows.

Assumption 1. *Offering direct flights is less costly than offering connecting flights. Among nonstop carriers, USAir's cost of offering nonstop service is higher than that of other legacy carriers. Among connecting carriers, USAir's cost of offering connecting services is lower than that of others. That is,*

$$\underbrace{\underline{\gamma}c \equiv c_{DL1} = c_{AA3} \leq c \equiv c_{USAir2}}_{Nonstop} \leq \underbrace{c_{USAir1} = c_{USAir3} \equiv \gamma\bar{c} \leq c_{AA1} = c_{AA2} = c_{DL2} = c_{DL3} \equiv \bar{c}}_{Connecting}.$$

Any postmerger changes in pricing strategies, which lead to softened competition, may be partly driven by cost-related efficiency gains from the merger. Given that AA's hubs have more traffic, the merger results in a more profitable business in the offer of nonstop services. To capture such gains from the merger, which alters the merged entity's optimal behaviors accordingly, we assume that $USAir$'s postmerger marginal cost of offering nonstop service in $m = 2$ is lower than its premerger cost. Additionally, AA also benefits from the merger on its connecting routes. Specifically, we assume that $\underline{\gamma}c \equiv c^M_{DL1} = c^M_{AA3} = c^M_{USAir2} \leq c^M_{USAir1} = c^M_{USAir3} = c^M_{AA1} = c^M_{AA2} \equiv \gamma\bar{c} \leq c^M_{DL2} = c^M_{DL3} \equiv \bar{c}$, where M denotes the postmerger case.

4.2 Incentive to Coordinate

Given the choice probability in Equation (1), each airline j chooses the optimal p_{jm} by solving Equation (3). Our focus is twofold: how the merger affects the incentive to coordinate (i) for $USAir$ as a merging entity and (ii) for DL as a nonmerging entity. The effect on DL is particularly important since it is directly related to the coordinated effects of the merger we are interested in.

Note that both DL and UA are classified as nonmerging carriers; for the sake of discussion, we focus on the effect of the merger on DL below. Additionally, as mentioned earlier, our setup views any changes in the postmerger competitive structure, followed by changes in pricing strategies, as resulting from the changes in the cost structure: the cost asymmetry, which arises from the airline type (i.e., $USAir$ or other legacy carriers) before the merger, arises from the merger status (i.e., merging or nonmerging) after the merger.

Assuming that DL deviates in the first period, coordination is sustainable if the following inequality holds:

$$\frac{\Pi_{DL}}{1-\delta} \geq \Pi^d_{DL} + \frac{\delta\Pi^n_{DL}}{1-\delta}. \tag{4}$$

That is, the critical discount factor, δ^*_{DL}, above which coordination can be sustained, is obtained by

rearranging Equation (4) as follows:

$$\delta^*_{DL} = \frac{\Pi^d_{DL} - \Pi_{DL}}{\Pi^d_{DL} - \Pi^n_{DL}}. \tag{5}$$

Similarly, $USAir$ continues coordinating as long as $\delta > \delta^*_{USAir} \equiv \frac{\Pi^d_{USAir} - \Pi_{USAir}}{\Pi^d_{USAir} - \Pi^n_{USAir}}$.

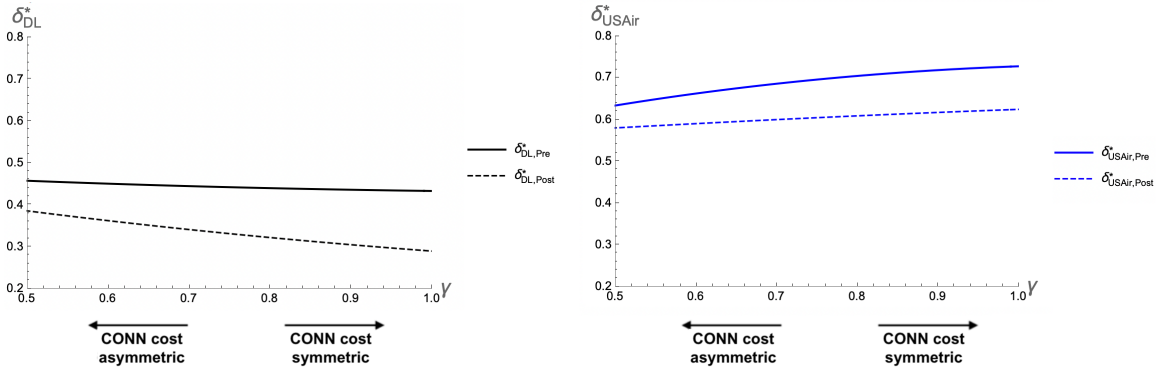


Figure 4: $\delta^*_{DL,Pre}$ and $\delta^*_{DL,Post}$ (left) and $\delta^*_{USAir,Pre}$ and $\delta^*_{USAir,Post}$ as a function of γ with $\underline{\gamma} = 0.8$, assuming that $\sigma = 0.5$, $\eta = -0.5$, $\phi_{jm} = 2\ \forall\ j$ and m, $\alpha = -0.3$, $\bar{c} = 2$, and $c = 1.2$

From the numerical exercise, we first find that the value of $\underline{\gamma}$ does not impact the effect of γ on the sustainability of collusion, represented by $\delta^*_{j,Pre}$ (premerger) and $\delta^*_{j,Post}$ (postmerger) where $j \in \{DL, USAir\}$. Thus, to better focus on the cost asymmetry on connecting routes, we assume that $\underline{\gamma} = 0.8$ and plot pre- and postmerger thresholds in terms of γ. Then, we see how the two thresholds change as the cost asymmetry between $USAir$ and other legacy carriers changes, reflected by γ, and how the merger impacts this effect.

As shown in the left panel in Figure 4, we find that $\delta^*_{DL,Pre} > \delta^*_{DL,Post}$, implying that the merger makes coordination with DL easier to sustain. These merger-driven coordination effects arise from *deviation-mitigating effects* for DL. Given that the AA/USAir merger relaxes the competition by facilitating perfect coordination with all carriers, including $USAir$, both the collusion and deviation profit levels for DL increase after the merger; however, the former increases more than the latter, as similarly described in Igami and Sugaya (2021). That is, postmerger, deviation is relatively less profitable than collusion since the merger allows the merged carrier to have efficiency gains that would yield DL a lower profit if it initiates a price war with the merged carrier.[5]

Comparing the two panels in Figure 4, we also find that $USAir$ is the least likely to participate in coordination premerger—given our assumption on cost asymmetry, we claim that the asymmetric cost structure for $USAir$ can drive this result.[6] However, $USAir$ becomes more willing to participate

[5]Note that we confirm that both AA and $USAir$ have an incentive to merge in the first place by checking that their per period joint profit before the merger is always less than that after the merger.

[6]The premerger critical discount factor for AA is analogous to that for DL given their symmetric cost structure.

in coordination post merger, i.e., $\delta^*_{USAir,Pre} > \delta^*_{USAir,Post}$. Post merger, the cost structure of $USAir$ becomes similar to other players including nonmerging entity DL. Due to this more symmetric cost structure, $USAir$ has more incentive to coordinate after the merger.

Additionally, we find that δ^*_{USAir} increases in γ regardless of merger status, meaning that $USAir$ is less likely to coordinate as cost becomes symmetric. With a larger γ, there is less distinct cost advantage for $USAir$, making it lose more customers on connecting routes from price coordination. Thus, $USAir$ becomes reluctant to coordinate as its cost advantage vanishes.

Taken together, the theoretical findings show how merger-driven cost efficiency, which allows $USAir$ to overcome its cost disadvantage when offering nonstop service, affects the incentive to coordinate. Specifically, the cost efficiency gained by the merging entity can reduce DL's incentive to engage in aggressive pricing against $USAir$, which leads to the coordinated effects of the merger for the nonmerging entity. Finally, such coordinated effects toward nonmerging entity DL become more salient postmerger given that DL is more likely to sustain collusion after the merger.

5 Discussion

In this section, we discuss the potential importance of connecting flights to airline antitrust issues and the merger remedies imposed in the AA/USAir merger.

5.1 Connecting vs. Nonstop

In the airline industry, while nonstop services are typically effective at constraining rivals' market power, connecting flights are considered a poor substitute with limited ability to restrain rivals from raising prices. For that reason, nonstop flight services in concentrated markets have been the core elements of analysis in merger reviews in the industry (e.g., routes on which the merging carriers hold a nonstop duopoly). However, connecting services can play a crucial role in airline market competition, and a careful examination of mergers' effects on them may be required. As documented in this paper, the Advantage Fares employed by $USAir$ had disrupted industry norms and induced intense competition across multiple routes. When the AA/USAir merger eliminated the price discounting program, the market competition originating from those connecting flights softened. One might argue that only a small number of passengers on a route would be affected by these changes, but the regression results in Section 3 indicate that the merger is associated with a substantial reduction in passenger levels (e.g., a more than 20% reduction on *[USAir's NS Route]*, relative to those on *[Nobody's NS Route]*). In addition, one important factor to consider is the sheer number of routes and

Table 5: Tabulation of Routes by Market Group in 2013Q2

Group	Category	N. Markets	2013Q2 Passengers (mil.)		
			Connecting	Nonstop	Total
A	All Markets	8665	23.6	71.6	95.2
B	Both AA and USAir Nonstop	24	0.0	1.2	1.2
C	Major3 NS and USAir Conn	1344	4.9	30.5	35.4
	USAir NS and Major3 Conn	341	1.3	5.4	6.8

Note: This table shows the number of routes and passengers in different types of market groups. 'All Markets' in Group A indicates the entire market. 'Both AA and USAir Nonstop' in Group B refers to the set of routes on which AA and $USAir$ are nonstop duopolists. 'Major3 NS and USAir Conn' shows the set of routes on which one of the three major legacy carriers AA, DL, UA is the only nonstop carrier and US Airways offers connecting services. Similarly, 'USAir NS and Major3 Conn' refers to the set of routes on which US Airways is the only nonstop service provider and at least one of the three legacy carriers offers connecting services.

the aggregated number of passengers across all affected routes.

Table 5 tabulates the number of markets and passengers in the second quarter of 2013. It shows that there are, in total, 8,665 markets with 95.2 million passengers, and connecting passengers account for 25% of the total. When we focus on the set of routes on which AA and $USAir$ hold a nonstop duopoly, we find that these represent only 1.2 million passengers in 24 markets (or 1.26% of total passengers). In regard to those routes affected by Advantage Fares, which are routes on which one of the three legacy carriers offers nonstop service and $USAir$ offers connecting service or vice versa, there are approximately 1,700 markets (Group C) with 42.2 million passengers in total. Even if we restrict our focus to connecting passengers, 26.3% of the total connecting passengers are in this category. This implies that potential consumer harm due to the AA/USAir merger on nonstop duopoly routes (Group B) could be substantial in a small number of markets, whereas the harm due to the elimination of Advantage Fares (Group C) could be small at the route level but considerably large if we aggregate the welfare losses from all connecting routes and their passengers. This suggests that for an airline merger review process, considering the consumer harm coming from connecting services across a wide range of routes can be as crucial as examining a set of small number of nonstop duopoly routes.

5.2 Merger Remedies

The AA/USAir merger was approved with remedies that primarily addressed the merger's potential unilateral effects without considering the specific effect of eliminating a firm implementing a disruptive pricing strategy or coordinated effects. Before the trial started, the parties settled on a set of structural remedies that included requiring the merging carriers to divest some of their airport landing slots and gate accesses at a few slot-controlled airports (e.g., Washington D.C. Reagan National Airport (DCA)

and New York LaGuardia Airport (LGA)) to low-cost carriers (LCCs). The divestitures would allow LCCs to increase their operating capacity at those airports and mitigate potential consumer harm from the merging carriers obtaining greater market power, but they were not designed to prevent rival carriers from engaging in collusive conduct (Peterman (2014)). Although the DOJ claimed that the potential benefits of LCC entry and expansion through divestitures could be comparable to those of Advantage Fares (Department of Justice. (2014)) *ex post*, LCC route expansion focused on a limited number of routes based on DCA and LGA.[7] Furthermore, as Loertscher and Marx (2021) mention, asset divestitures as a merger remedy can raise greater concerns about coordinated effects, even when they resolve unilateral effects.

Our analysis suggests that it is important not to overlook coordinated effects. If a merger can potentially soften price competition by eliminating disruptive innovation, such as Advantage Fares, competition authorities need to take extra care in considering whether to challenge the merger by quantifying the market harm originating from the acquisition of the firm that offers the substantial price discount. As Horizontal Merger Guidelines (Department of Justice) (2010) notes, if a merger partner acquires such a firm, it can be evidence of adverse effects of the merger. As we stated earlier, in the AA/USAir merger, the DOJ's effort to resolve the merger's anticompetitive effects did not focus on its coordinated effects. This may have been partly because connecting flights were not crucial aspects of the airline merger review or partly because any remedies that could have preserved Advantage Fares would have been costly (e.g., behavioral remedies forcing the merged entity to continue to provide Advantage Fares postmerger, which could involve a high monitoring cost).

However, as stated in Section 5.1, the low consumer harm due to the elimination of Advantage Fares becomes substantial when aggregated across all affected routes; therefore, any remedies to address this harm may have been justifiable if the aggregated harm exceeded the costs arising from the remedies. In such cases, the authorities might need to consider remedies, especially when they do not want to reject the proposed merger but do aim to preserve disruptive innovation that the so-called maverick firm brings to the market.

[7]For example, although the divestitures at DCA allowed LCCs to increase their passenger share from 13.7% in 2013 to 24.8% in 2016, overall passenger growth at the airport was similar to nationwide growth Park (2020). In regard to entry, LCCs who received airport slots tended to add leisure-based destinations from DCA, such as Fort Lauderdale and Tampa (Southwest) and Palm Beach (JetBlue).

6 Concluding Remarks

This paper studies the coordinated effects of the merger between American Airlines (AA) and US Airways ($USAir$). We find, both theoretically and empirically, that the merger, which eliminated the Advantage Fares employed by $USAir$, softened price competition between the merging and nonmerging carriers. Specifically, nonmerging legacy carriers (i.e., DL and UA), which had set lower prices in $USAir$'s nonstop monopoly market premerger, no longer employed such aggressive pricing after the merger. This empirical evidence of a postmerger price increase for nonmerging entities is supported by the theory of coordinated effects that focuses on cost asymmetry among airlines.

Although it is possible that the AA/USAir merger weakened market competition through both unilateral and coordinated effects, less attention has been paid to the latter: while settlement remedies requiring the divestiture of slots and gates at several airports resolved the unilateral effects, they did not eliminate anticompetitive harm from coordinated effects. For airline merger evaluations, in particular, one possible reason for such neglect is that competitive authorities overlook the importance of connecting flights: given that Advantage Fares applied only to connecting routes, which are known to be less effective in restricting rivals' market power, the adverse effects of eliminating Advantage Fares following the merger are likely to have been underestimated. We emphasize that the aggregate effects of connecting services, if summed over all markets, are likely to correspond to a significant impact on market competition, which is a subject deserving more attention. Indeed, by primarily focusing on the effects of mergers on connecting routes, we find substantial price increases among nonmerging carriers.

In particular, when a market is more vulnerable to coordinated conduct, as is the case for the airline industry, with its high price transparency, coordination among firms is likely to exist even premerger. Then, postmerger coordination is rather obvious and thus requires more careful merger reviews. Furthermore, if a proposed merger involves a firm implementing a disruptive pricing strategy, competitive authorities may need to examine the scenario more closely.

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Appendix

A Tables

Table A1: Regression Result: Connecting Flights Offered by DL or UA

	log(90th price)				log(avg price)	log(passengers)
	(1)	(2)	(3)	(4)	(5)	(6)
[USAir's NS Route]	-0.241***	-0.154***	-0.173***	-0.151***	-0.139***	0.297**
	(0.041)	(0.038)	(0.029)	(0.038)	(0.030)	(0.132)
[Post] × [USAir's NS Route]	0.222***	0.135***	0.170***	0.077**	0.097**	-0.218***
	(0.041)	(0.039)	(0.025)	(0.035)	(0.038)	(0.043)
[Major3's NS Route]		0.091***	0.095***	0.093***	0.032**	-0.148***
		(0.016)	(0.013)	(0.016)	(0.014)	(0.049)
[Post] × [Major3's NS Route]		-0.109***	-0.116***	-0.139***	-0.084***	0.193***
		(0.013)	(0.007)	(0.012)	(0.011)	(0.041)
[Southwest's NS Route]	-0.291***	-0.176***	-0.178***	-0.175***	-0.173***	0.251***
	(0.025)	(0.011)	(0.009)	(0.011)	(0.010)	(0.053)
[Post] × [Southwest's NS Route]	0.282***	0.152***	0.153***	0.103***	0.122***	-0.272***
	(0.026)	(0.013)	(0.010)	(0.011)	(0.012)	(0.036)
[Others' NS Route]	-0.294***	-0.147***	-0.138***	-0.147***	-0.151***	0.268
	(0.029)	(0.027)	(0.017)	(0.027)	(0.021)	(0.175)
[Post] × [Others' NS Route]	0.184***	0.020	0.003	0.000	0.013	0.033
	(0.049)	(0.039)	(0.019)	(0.035)	(0.029)	(0.130)
Airport Presence (Origin)	0.220***	0.151***	0.154***	0.157***	0.132***	0.594***
	(0.032)	(0.006)	(0.006)	(0.006)	(0.006)	(0.037)
Airport Presence (Destination)	0.208***	0.128***	0.131***	0.131***	0.114***	0.692***
	(0.043)	(0.016)	(0.015)	(0.017)	(0.015)	(0.079)
Distance (1,000 miles)	0.192***	0.189***	0.189***	0.193***	0.168***	0.198***
	(0.011)	(0.005)	(0.005)	(0.005)	(0.005)	(0.032)
Number of Low Cost Carriers	-0.026***	-0.034***	-0.032***	-0.033***	-0.049***	0.229***
	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.018)
R^2	0.562	0.529	0.440	0.535	0.619	0.420
Observations	58,095	286,313	286,313	366,366	286,313	286,313
Excluding 2014-2015 obs?	Yes	Yes	Yes	No	Yes	Yes
Control Group (whose NS Route?)	Major3's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time and Route fixed effects	✓	✓	✓	✓	✓	✓
Year-Route fixed effects	✓	✓		✓	✓	✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by DL or United. 'Excluding 2014-2015 obs?" indicates whether the sample excludes the observations of year 2014 and 2015. 'Control Group (whose NS Route?)' indicates which nonstop route group is served as an ommitted reference group. Standard errors are in the parenthesis and clustered at the route-level.

Table A2: Regression Result: Connecting Flights Offered by DL or UA (Group by ΔHHI)

Premerger ΔHHI	log(90th price)					
	$\Delta HHI = [0, 50)$		$\Delta HHI = [50, 200)$		$\Delta HHI = [200, \infty)$	
	(1)	(2)	(3)	(4)	(5)	(6)
[USAir's NS Route]	-0.186***	-0.150***	-0.075	-0.045	-0.151***	-0.144***
	(0.026)	(0.029)	(0.072)	(0.102)	(0.034)	(0.048)
[Post] × [USAir's NS Route]	0.215***	0.149***	-0.002	-0.055	0.112***	0.098**
	(0.025)	(0.033)	(0.061)	(0.111)	(0.025)	(0.048)
[Major3's NS Route]	0.113***	0.102***	0.154***	0.160***	0.027	0.033
	(0.016)	(0.020)	(0.020)	(0.026)	(0.023)	(0.037)
[Post] × [Major3's NS Route]	-0.116***	-0.097***	-0.184***	-0.198***	-0.095***	-0.104***
	(0.009)	(0.017)	(0.015)	(0.026)	(0.013)	(0.038)
[Southwest's NS Route]	-0.171***	-0.167***	-0.197***	-0.177***	0.112*	0.096***
	(0.010)	(0.013)	(0.011)	(0.014)	(0.060)	(0.008)
[Post] × [Southwest's NS Route]	0.144***	0.143***	0.243***	0.204***	-0.198**	-0.157***
	(0.011)	(0.014)	(0.016)	(0.022)	(0.091)	(0.007)
[Others' NS Route]	-0.134***	-0.147***	-0.102**	-0.114*	-0.030	0.020*
	(0.017)	(0.028)	(0.042)	(0.061)	(0.057)	(0.011)
[Post] × [Others' NS Route]	0.009	0.036	0.024	0.038	-0.119	-0.210***
	(0.020)	(0.041)	(0.027)	(0.054)	(0.098)	(0.010)
Airport Presence (Origin)	0.167***	0.164***	0.119***	0.114***	0.139***	0.140***
	(0.007)	(0.007)	(0.016)	(0.017)	(0.013)	(0.014)
Airport Presence (Destination)	0.143***	0.138***	0.131***	0.129***	0.119***	0.122***
	(0.012)	(0.013)	(0.027)	(0.029)	(0.024)	(0.027)
Distance (1,000 miles)	0.204***	0.204***	0.146***	0.148***	0.116***	0.118***
	(0.007)	(0.007)	(0.010)	(0.011)	(0.008)	(0.009)
Number of Low Cost Carriers	-0.036***	-0.040***	-0.019***	-0.017***	-0.022***	-0.022***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
R^2	0.460	0.550	0.404	0.510	0.348	0.455
Observations	191,506	191,506	34,546	34,546	60,261	60,261
Control Group (whose NS Route?)	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time and Route fixed effects	✓	✓	✓	✓	✓	✓
Year-Route fixed effects		✓		✓		✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by DL or UA. The omitted reference route group is [Nobody's NS Route]. The sample period is between the first quarter of 2011 and the last quarter of 2019 excluding the year 2014 and 2015. Standard errors are in the parenthesis and clustered at the route-level.

Table A3: Regression Result: Connecting Flights Offered by DL or UA

		log(90th price)			log(avg price)	log(passengers)
	(1)	(2)	(3)	(4)	(5)	(6)
[USAir's NS Route]		0.091***	0.088***	0.108***	0.075***	-0.583***
		(0.028)	(0.024)	(0.028)	(0.025)	(0.101)
[DL or UA's NS Route]	0.018	-0.066***	-0.071***	-0.067***	-0.025***	0.466***
	(0.034)	(0.011)	(0.013)	(0.011)	(0.009)	(0.064)
[Post] × [DL or UA's NS Route]	-0.059***	0.073***	0.080***	0.027***	0.004	-0.504***
	(0.016)	(0.012)	(0.008)	(0.009)	(0.013)	(0.061)
[Southwest's NS Route]	-0.071**	-0.156***	-0.170***	-0.156***	-0.137***	0.301***
	(0.029)	(0.012)	(0.009)	(0.012)	(0.010)	(0.084)
[Post] × [Southwest's NS Route]		0.147***	0.166***	0.089***	0.106***	-0.428***
		(0.016)	(0.010)	(0.013)	(0.013)	(0.084)
[Others' NS Route]	-0.064*	-0.132***	-0.138***	-0.130***	-0.118***	0.176
	(0.035)	(0.021)	(0.018)	(0.021)	(0.015)	(0.160)
[Post] × [Others' NS Route]	-0.064**	0.039**	0.049***	0.005	0.019	-0.282***
	(0.029)	(0.016)	(0.012)	(0.015)	(0.013)	(0.079)
Airport Presence (Origin)	0.240***	0.153***	0.147***	0.153***	0.119***	0.494***
	(0.027)	(0.012)	(0.009)	(0.011)	(0.011)	(0.050)
Airport Presence (Destination)	-0.018	0.006	0.093***	0.021	-0.031	0.184*
	(0.073)	(0.025)	(0.014)	(0.024)	(0.025)	(0.097)
Distance (1,000 miles)	0.194***	0.185***	0.184***	0.181***	0.165***	0.141***
	(0.012)	(0.004)	(0.004)	(0.004)	(0.004)	(0.039)
Number of Low Cost Carriers	-0.043***	-0.034***	-0.035***	-0.037***	-0.047***	0.248***
	(0.007)	(0.004)	(0.003)	(0.004)	(0.004)	(0.019)
R^2	0.630	0.601	0.498	0.601	0.665	0.611
Observations	33,406	143,868	143,868	190,058	143,868	143,868
Excluding 2014-2015 obs?	Yes	Yes	Yes	No	Yes	Yes
Control Group (whose NS Route?)	USAir's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time and Route fixed effects	✓	✓	✓	✓	✓	✓
Year-Route fixed effects	✓	✓		✓	✓	✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by Delta or United. 'Excluding 2014-2015 obs?" indicates whether the sample excludes the observations of year 2014 and 2015. 'Control Group (whose NS Route?)' indicates which nonstop route group is served as an ommitted reference group. Standard errors are in the parenthesis and clustered at the route-level.

Table A4: Regression Result: Connecting Flights Offered by DL or UA (Robustness Check)

	Excluding slot constrained airports			Using a balanced panel			Quarters to be a dominant carrier = 8			Quarters to be a dominant carrier = 4		
	log(90th price)	log(avg price)	log(passengers)	log(90th price)	log(avg price)	log(passengers)	log(90th price)	log(avg price)	log(passengers)	log(90th price)	log(avg price)	log(passengers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
[USAir's NS Route]	-0.214***	-0.178***	0.433***	-0.168***	-0.139***	-0.241***	-0.162***	-0.148***	0.302**	-0.183***	-0.162***	0.467***
	(0.021)	(0.021)	(0.117)	(0.042)	(0.038)	(0.086)	(0.040)	(0.032)	(0.128)	(0.033)	(0.027)	(0.105)
[Post] × [USAir's NS Route]	0.197***	0.147***	-0.225***	0.110**	0.057	-0.253***	0.145***	0.109**	-0.252***	0.182***	0.143***	-0.306***
	(0.023)	(0.024)	(0.053)	(0.048)	(0.058)	(0.085)	(0.044)	(0.045)	(0.035)	(0.032)	(0.034)	(0.041)
[Major3's NS Route]	0.092***	0.035**	-0.129**	0.060***	0.008	-0.493***	0.106***	0.045***	-0.201***	0.121***	0.062***	-0.211***
	(0.017)	(0.015)	(0.051)	(0.020)	(0.018)	(0.057)	(0.017)	(0.014)	(0.050)	(0.018)	(0.015)	(0.056)
[Post] × [Major3's NS Route]	-0.109***	-0.084***	0.204***	-0.101***	-0.077***	0.274***	-0.123***	-0.093***	0.233***	-0.129***	-0.097***	0.258***
	(0.014)	(0.012)	(0.043)	(0.016)	(0.015)	(0.046)	(0.013)	(0.011)	(0.041)	(0.015)	(0.012)	(0.041)
[Southwest's NS Route]	-0.177***	-0.174***	0.264***	-0.176***	-0.186***	-0.172***	-0.186***	-0.183***	0.251***	-0.185***	-0.184***	0.314***
	(0.011)	(0.010)	(0.053)	(0.021)	(0.015)	(0.055)	(0.011)	(0.010)	(0.051)	(0.012)	(0.010)	(0.048)
[Post] × [Southwest's NS Route]	0.151***	0.121***	-0.274***	0.101***	0.101***	-0.250***	0.150***	0.122***	-0.186***	0.151***	0.120***	-0.189***
	(0.013)	(0.012)	(0.036)	(0.020)	(0.017)	(0.072)	(0.013)	(0.012)	(0.041)	(0.011)	(0.010)	(0.042)
[Others' NS Route]	-0.150***	-0.156***	0.254	-0.148***	-0.142***	-0.230*	-0.152***	-0.152***	0.284*	-0.158***	-0.155***	0.414***
	(0.030)	(0.022)	(0.193)	(0.033)	(0.028)	(0.133)	(0.029)	(0.024)	(0.168)	(0.028)	(0.026)	(0.152)
[Post] × [Others' NS Route]	0.021	0.013	0.027	0.007	-0.020	0.100	0.015	0.005	0.056	0.008	-0.010	-0.004
	(0.041)	(0.031)	(0.140)	(0.047)	(0.033)	(0.124)	(0.039)	(0.029)	(0.124)	(0.038)	(0.032)	(0.117)
Airport Presence (Origin)	0.144***	0.129***	0.621***	0.167***	0.146***	0.506***	0.143***	0.125***	0.605***	0.137***	0.118***	0.652***
	(0.006)	(0.006)	(0.039)	(0.009)	(0.008)	(0.050)	(0.006)	(0.006)	(0.040)	(0.006)	(0.006)	(0.042)
Airport Presence (Destination)	0.117***	0.107***	0.719***	0.119***	0.108***	0.570***	0.121***	0.105***	0.701***	0.116***	0.099***	0.735***
	(0.016)	(0.015)	(0.083)	(0.019)	(0.018)	(0.079)	(0.016)	(0.014)	(0.081)	(0.017)	(0.015)	(0.082)
Distance (1,000 miles)	0.192***	0.170***	0.189***	0.194***	0.177***	-0.057**	0.188***	0.167***	0.187***	0.189***	0.168***	0.179***
	(0.005)	(0.005)	(0.034)	(0.006)	(0.006)	(0.027)	(0.006)	(0.005)	(0.032)	(0.006)	(0.005)	(0.032)
Number of Low Cost Carriers	-0.033***	-0.049***	0.228***	-0.050***	-0.064***	-0.053***	-0.028***	-0.043***	0.217***	-0.025***	-0.039***	0.203***
	(0.004)	(0.004)	(0.018)	(0.006)	(0.006)	(0.019)	(0.004)	(0.003)	(0.018)	(0.003)	(0.003)	(0.019)
R^2	0.535	0.624	0.421	0.516	0.620	0.418	0.531	0.622	0.419	0.533	0.624	0.423
Observations	270,198	270,198	270,198	135,533	135,533	135,533	278,136	278,136	278,136	268,893	268,893	268,893
Balanced Panel?	No	No	No	Yes	Yes	Yes	No	No	No	No	No	No
Control Group (whose NS Route?)	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's	Nobody's
Time, Route and Year-Route fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: This table shows the regression result of relevant variables when the sample is restricted to those connecting flights offered by Delta or United. Control Group (whose NS Route?) indicates which nonstop route group is served as an omitted reference group. The sample period is between the first quarter of 2011 and the last quarter of 2019 excluding the year 2014 and 2015. Standard errors are in the parenthesis and clustered at the route-level.