Examining the Airline Industry in the Context of the 2023 Merger Guidelines

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Abstract
In December of 2023, the Federal Trade Commission and Department of Justice released a new set of Merger Guidelines. Among these guidelines was an added presumption against mergers with a market HHI greater than 1,800 and a change in HHI greater than 100, or a firm with a merged market share greater than 30% and a change in HHI greater than 100. Previous research estimates the causal effect on prices of various mergers in the airline industry; but my paper is the first to try to assess whether mergers that would be caught only by the 2023 guidelines tend to have anticompetitive effects. Using the Department of Transportation Ticket Dollar Value Database DB1B data, I identify airline markets that fall under the threshold for presumption under both the old and new merger guidelines, and using a difference-in-differences method as a function of market concentration, estimate the causal effect on prices from recent mergers. I find that the 2010 guidelines are effective at identifying markets with slightly increased prices, and markets identified by the 2010 guidelines see between a 1.14% and 2.91% increase in prices post-merger. Furthermore, markets identified by the 2023 guidelines do see a similar increase in prices, which ranges from 0.75% to 2.39%; however, the effect under both guidelines is heavily dependent on how I treat connecting markets. Additionally, output decreases slightly on routes identified by the presumption of both sets of guidelines. Overall, this suggests that the change in the 2023 Guidelines may be effective at identifying markets where consumers will be harmed post-merger.

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1 Introduction

The merger review process is pivotal in identifying potentially harmful markets and protecting consumer welfare. Mergers allow firms to increase their market power and have a greater influence on prices and quantities. Research that investigates specific effects on prices assists in identifying specific mergers that cause greater price increases. Specifically in the case of this paper, research can identify how effective current regulation is at identifying mergers that are harmful to consumers and provide insight to regulators about the efficacy of specific guidelines.

On December 18, 2023, the Department of Justice and Federal Trade Commission released a set of Merger Guidelines. Among these new guidelines were tighter regulations for increases in market share and Herfindahl-Hirschman Index (HHI)[1] in the assessment of horizontal mergers. This would be one of the more significant changes to the merger guidelines, and its effects on how acquisitions and mergers are carried out will have impact on firms and consumers.

The most recent 2010 guidelines contained a presumption[2] against mergers where the post-merger HHI is greater than 2500 and the change in HHI as a result of the two firms merging is greater than or equal to 200. The 2023 guidelines tightened these restrictions, and now contain a presumption against mergers with a post-merger HHI greater than 1800 and a change in HHI greater than or equal to 100, or a merged firm with a market share greater than 30% and a change in HHI greater than or equal to 100.

Incorrectly expanding the reach of the guidelines can undermine the legitimacy of them, and potentially incur additional costs on firms, consumers, and agencies. For this reason, it is

[1] HHI is defined as the sum of squared market shares in an industry.
[2] A presumption denotes an assumption by regulators that a merger will see negative effects.

important that if any change is made to the guidelines, especially a change as significant as those added in 2023, it actually helps identify potentially anticompetitive mergers. There is significant retrospective research in the air travel industry, and I add to this research by specifically looking at prior mergers and whether the extension of the guidelines would allow agencies to identify a new set of markets where anticompetitive effects are observed.

In the airline industry, carriers provide many different "products" in the form of routes. In the dataset, some carriers serve tens of thousands of routes. This leads to an abundance of different combinations of market shares that can be observed. Being able to observe an industry with many recent mergers and many markets where the merging firms are present is unique and can not only provide insight into the effects of mergers in the airline industry, but also potentially into the effects of mergers in all industries. Additionally, there have been 13 different mergers in this industry since 1993, giving an abundance of individual mergers to investigate. Lastly, air travel is imperative to the global economy, and mergers in this industry may affect many consumers.

In this paper, I investigate the how prices in markets that would have been caught by the 2023 guidelines and markets that would have been caught by the 2010 guidelines differ from those that would not have been caught by either. Employing a difference-in-differences approach with fixed effects on route, time, and carrier, I compare the change in weighted average price of markets with only one merging firm present[3] to that of markets with both merging firms present that were caught by either the 2010 or 2023 guidelines to estimate how price effects differ by the set of guidelines that are applied.

[3] For example, in the case of the UA/CO merger, a market where UA or CO is present, but not both.

I conclude that the 2010 guidelines are somewhat effective at identifying markets with increased prices post-merger. Furthermore, markets identified by the 2023 guidelines are associated with higher prices post-merger, but that effect is highly sensitive to whether a route has a connection. Under all specifications including connecting flights, markets identified by the 2010 guidelines have a statistically significant, positive effect on prices, which ranges from 0.75% to 2.91%. The effect on prices of mergers caught by the 2023 guidelines is less sensitive to how connections are specified, but the observed effect ranges from 1.79% to 2.39%. The observed effect on nonstop routes identified by 2023 is statistically insignificant.

Output also decreases by about 2% on routes identified by the 2023 guidelines, and the estimated decrease in output on routes identified by the 2023 guidelines ranges from 0 to 3.68%, depending on how markets are specified. This result, overall, suggests that both sets of guidelines are effective at identifying markets where consumers will be harmed post-merger.

2 Merger Review and The Industry

It is first important to understand the role of the merger guidelines. Merger guidelines are not law, and for this reason it is possible for mergers that violate the presumption in one or more markets to be allowed, or mergers that do not violate the presumption to be challenged. The intention is that the guidelines provide judges with an idea of where economists think the presumption should lie and give firms an idea of what is likely to be challenged in court. This leads to a unique dynamic where it is important that the threshold does not overreach, because if the threshold would identify markets that are not anticompetitive, judges and firms would stop abiding by them, which would defeat the purpose of the guidelines' existence. For this reason, it is important that the merger guidelines are effective at identifying anticompetitive markets.

The primary objective of the DOJ and FTC in merger regulation is to prevent reductions in competition. The underlying assumption is that competition leads to innovation, and innovation is beneficial to consumers. Allowing highly concentrated markets to be created by merging would prevent competitors from entering the market and decrease competition, which is antithetical to regulators' goal. Specifically, the additional restrictions added in the 2023 guidelines are intended to uphold Section 7 of the Clayton Act which prohibits mergers and acquisitions "in any line of commerce or in any activity affecting commerce in any section of the country, the effect of such acquisition may be substantially to lessen competition, or to tend to create a monopoly." (Clayton Act, 15 U.S.C. § 18.) These guidelines are intended to identify mergers that "significantly increase concentration in highly concentrated markets." (FTC, 2023) in order to promote innovation.

In airline markets specifically, city-city or airport-airport travelers often have only a few carrier choices, therefore a merger may increase concentration substantially, theoretically leading to an increase in price. On the other hand, a merger may create efficiencies such as a larger selection of routes from certain airports. Ultimately, the direct effects on price come down to specific market dynamics, and oftentimes the market shares of firms can make a market more or less likely to end up with higher prices.

One additional element to consider is that prices are not the only factor affecting consumer welfare, but it is difficult to estimate consumer welfare in this market. The experience of a customer on an airline can greatly differ, and price is not the only factor that affects a consumer's welfare.

2.1 Literature Review

Overall, there is no consensus about the effect of market share of merging firms on prices. What we can learn from literature, however, is that the price effect of a merger depends upon the geographic presence of both merging firms, type of consumer the firms cater to, and existence of competition in the market, and that in general, mergers lead to price increases.

The effect on prices of a merger is often determined by the type of airline involved in the merger. Generally, it is believed that the presence of competition among Low Cost Carriers (LCC's) tends to have greater negative price effects than competition among Legacy carriers (Brueckner, Lee, Singer, 2013a). LCC's are more likely to use point-to-point transit as opposed to hub-and-spoke models (Cook & Goodwin, 2008), which helps lead to this effect.

Existing literature suggests varying price effects of mergers in the airline industry. Some suggest that the recent mergers, such as Delta Airlines and Northwest Airways, United Airlines and Continental Airlines, and American Airlines and US Airways have had pro-competitive effects (Carlton, Israel, MacSwain, & Orlov, 2019), while others suggest that mergers lead to significant price increases, especially in markets where one airline controls a large portion of traffic at a specific airport (Borenstein, 1990).

In 2005, America West merged with US Airways. This merger was observed to lead to relatively significant price increases; however, literature suggests that consumer welfare likely increased as there were price decreases on routes where there was not a significant competitor prior to the merger (Hüschelrath & Müller, 2014).

In 2010, Delta Air Lines merged with Northwest Airlines. Literature observes that there was no statistically significant price increase in connecting markets, and a slight price increase in nonstop markets (Luo, 2013). This is consistent with other research that suggests competition

among Legacy Carriers has smaller price effects than those involving LCC's (Brueckner, Lee, Singer, 2013a).

The 2011 merger between United Airlines and Continental Airlines is observed to have different effects depending on the type of traveler and type of route. Generally, hub markets experienced an increase in prices, leisure markets experienced a drop in prices, and business markets experienced an increase in prices. This can be attributed to the elasticity of demand for different travelers and does suggest that mergers can lead to an increase in market power (Fan, 2020). This paper is also relatively unique in the way it identifies business and leisure markets. Other research on this merger found slightly reduced fares, and does not suggest anticompetitive effects (Jain, 2015).

The 2011 merger between Southwest and AirTran was unique, as it was the first merger in the United States between two relatively large LCCs. Literature suggests different effects depending on the level of competition in the market. There was an observed price increase as a result of the merger in all markets, and a 13% decrease in output on routes with potential competition from other carriers, with no change in output on routes with actual competition. This demonstrates a greater negative effect on consumer welfare in markets with potential competition eliminated than markets with actual competition eliminated (Le, 2016).

The largest merger in this dataset is between US Airways and American Airlines. Reasonably, this merger has the most retrospective literature. This merger faced severe scrutiny from the DOJ. Ultimately, American Airlines was responsible for the divestiture of various slots at certain large airports around the country to LCC's to encourage competition. Of the mergers in this dataset, US/AA was the only one to face such heavy scrutiny, and although some literature suggests it did not have anticompetitive effects (Carlton, Israel, MacSwain, &

Orlov, 2019), others suggest it had significantly higher impacts on markups than other mergers (Bet, 2021).

Ultimately, research around the merger suggests the divestiture offset the potentially monopolistic effects of the merger. There were price increases in the market, but they were not found to be significant nor predatory. Additionally, other literature has found that decreases in fuel prices, changes in consumer preferences, and route optimization due to the merger have accounted for consumer surplus (Bontemps, Remmy, & Wei, 2022).

In order to compare my results with the work of other merger retrospectives that focus on specific mergers, I have compiled a table containing general results from some of the papers discussed. While this does not contain all of the results and discussions from these papers, and does not consider specific merger guidelines, it is still a solid baseline for comparison to my results. This table can be seen below.

All of this information leads to a relatively inconclusive result about "the effects of highly concentrated airline mergers on prices", but some general conclusions can be made. For one, generally speaking, mergers in the airline industry have increased prices. Secondly, the effects of a merger differ greatly depending on whether it is a LCC or Legacy Carrier. Overall, there is a lack of research investigating market share's overall effect in airline mergers, especially in the context of the 2023 Merger Guidelines, which is where my research can add to current discourse about protecting consumers in airline markets.

Table 1

Authors	Year	Merger	Control Group	Result
Dennis Carlton, Mark Israel, Ian MacSwain, Eugene Orlov	2017	DL/NW	Routes where there was not overlap prior to the merger	4.4% price decrease on nonstop routes, 3.7% price decrease on connecting routes
Dennis Carlton, Mark Israel, Ian MacSwain, Eugene Orlov	2017	UA/CO	Routes where there was not overlap prior to the merger	1.3% price decrease on nonstop routes, 3.6% price increase on connecting routes
Dennis Carlton, Mark Israel, Ian MacSwain, Eugene Orlov	2017	AA/US	Routes where there was not overlap prior to the merger	12.3% price decrease on nonstop routes, 1% price increase on connecting routes
Huubin B. Le	2016	WN/FL	Routes where neither airline competed prior to merger	7.68% price increase
Dan Luo	2014	DL/NW	Routes where there was not overlap prior to the merger	5.1% price increase on nonstop routes

3 Data

The data for this research originates from the US Department of Transportation DB1B database. The data contains a sample of 10% of reporting airline domestic itineraries with data such as origin, connection, destination, fare, and other relevant information. The data is aggregated by carrier, route, and quarter for every quarter from 1993 to the fourth quarter of 2022. In the data, each observation represents a route on a carrier for a quarter. For example, in the third quarter of 2021, on direct Southwest flights from Denver to Baltimore, 33,900 customers purchased tickets, the median fare was $189, and Southwest had a market share of 61.78%.

The data was then cleaned. Observations were removed if they had more than one connection or were not a domestic flight. Individual tickets with a price greater than $1,250 or less than $12.50 were removed. Any observation with a carrier with a passenger share less than 0.1%, or a route with fewer than 100 passengers for that quarter was removed, as this is likely a very small carrier or insignificant route for the analysis. Additionally, observations that included an airport that was not one of the 300 busiest airports in the United States based on enplanement for that year were dropped. This led to an overall attrition rate of 17.55% and 7.97 million overall observations.

Next, the data was merged with the T-100 Domestic Segment Data, allowing each market to have the origin, destination, and connection airport identified. Route codes were generated based on origin, connection, destination, year, and carrier, each of which defines an observation. Using existing variables such as total passengers, relevant variables like market share[4], HHI, and change in HHI[5] post-merger were calculated. Table 2 below demonstrates how HHI and change in HHI, "Delta-HHI", were calculated for a specific route.

Table 2

Carrier	**RouteID**	**NumPass**	**MktPass**	**MktShare**	**PreHHI**	**DeltaHHI**	**PostHHI**
AA	JFK_MIA_Nonstop	31160	54390	0.573	4942.06	240.66	5182.72
US	JFK_MIA_Nonstop	1130	54390	0.021	4942.06	240.66	5182.72
DL	JFK_MIA_Nonstop	22100	54390	0.406	4942.06	N/A	5182.72

[4] Market share in this data is identified by passenger share.
[5] Change in HHI is equal to 2 * (Firm A market share) * (Firm B market share)

To calculate market share, the share of passengers in that market was calculated for each carrier. Then, the sum of each market share (as a percentage) squared was calculated to equal pre-merger HHI. Since the change in HHI is only relevant for the two merging firms, to calculate Delta-HHI, the formula is 2 * 57.3 * 2.1 for this example. Then the post-merger HHI is calculated by adding Delta-HHI to the pre-merger HHI. This specific example uses nonstop routes from New York (JFK) to Miami in the fourth quarter of 2013. This market ends up very highly concentrated and would be caught under both the 2010 and 2023 guidelines. It is important to note that these values were calculated for each route during each quarter.

One important choice that was made was the definition of a market. Regressions with three different definitions of markets were ran. The raw data assumes that each origin/destination pair with a different connection is a different market. For example, a flight from Baltimore to Los Angeles connecting through Denver is considered different than a flight from Baltimore to Los Angeles connecting through Chicago. One could reasonably suggest that these two routes are extremely close substitutes for a consumer, and for this reason, I chose not to include this definition in my analysis.

The first regression defines markets as an origin/destination pair, ignoring any possible connections. This means that I am not differentiating by connection. The second regression defines markets using connection as a categorical variable. The first category is for nonstop flights, the second is for connecting flights that add 30% or less distance, and the final is for connecting flights that add more than 30% distance. Under these conditions, the aforementioned routes connecting through Denver and Chicago would be seen as the same and would be considered a short connection, but a route from Baltimore to Los Angeles connecting through Miami would be seen differently than those two and be considered a long connection, because

the connection adds more than 30% distance. A direct flight, under these specifications, would simply be considered “direct”. What this means is that short and long connections are considered different markets. Finally, the third regression treats connections as a binary variable. All three routes seen below would be considered the same market, but a nonstop flight from Baltimore to Los Angeles would be considered a different market.

Figure 1

Maps depicting the three described routes (retrieved from greatcirclemap.com

Throughout the rest of this paper, unless otherwise specified, the “default” definition of market contains connection as a categorical variable, as I believe this best represents how consumers would shop for flights. Nonstop flights are the most convenient, connecting flights are slightly different; however, connecting flights that add a similar amount of time to the route are close substitutes, and finally flights with longer, more inconvenient connections are seen as a third category.

To identify markets that fall under the threshold for presumption, the values were calculated as mentioned above. Then, routes where both firms were present, and the market shares created an environment where there would be a presumption were identified. For example, in the fourth quarter of 2009, prior to the Delta/Northwest merger, on nonstop flights

from Albuquerque to Minneapolis, Delta had a 2.98% market share, and Northwest had a 20.66% market share. Because the market HHI was greater than 1800 and the change in HHI was greater than 100, this market would've been presumed against under the 2023 guidelines. Prior to the merger the average price was $175.26, and after it was $182.47, representing a 4.1% price increase. While this is one specific example, it is a good example of how the presumption works.

For a comparison group in this analysis, there are two main options. First, one could reasonably suggest using the prices of other carriers on routes where both merging firms have a presence. This would allow control for any route-specific changes, such as an increase in fees to use an airport, that would affect price. The problem with this option is that prices of other carriers may be indirectly affected by a merger. For example, if there are three carriers present on a route and two of them merge, the merged carrier may change their prices, and the third carrier may be inclined to change their prices in response to this, especially if there is some type of collusion. This would add variation to the comparison group indirectly caused by the merger, which would impact the result. The second option is to use prices of the merging carriers on routes where only one is present as a comparison group. While this option cannot capture any route-specific changes, due to the large dataset, it is possible to create a strong comparison group. Due to this, I believe the inability to capture route-specific changes is less of a concern than indirect price effects caused by the merger. For this reason, I chose to use the latter as a comparison group. To establish this group, any route where both firms are present, but no guidelines were triggered was dropped.

After filtering the data to observations relevant to the analysis, 1,867,777 observations remain, containing 90 quarters from 1997 to 2019. There are 13 carriers represented, and 140,551 different routes. In the time period of these observations, 10 mergers occurred. For two

of the mergers, AirTran/Valujet and Southwest/Morris, there were not enough observations with overlap for them to be included in the analysis, therefore they are not considered in the regression. The eight mergers that were investigated can be seen below in table 3.

Table 3

Time of Merger	Merger	IATA Codes
1999 Q2	American Airlines / Reno Air	AA/QQ
2001 Q3	American Airlines / Trans World Airlines	AA/TW
2005 Q4	US Airways / America West Airways	US/HP
2010 Q1	Delta Airlines / Northwest Airlines	DL/NW
2011 Q1	United Airlines / Continental Airlines	UA/CO
2011 Q2	Southwest Airlines / Airtran Airways	WN/FL
2014 Q1	American Airlines / US Airways	AA/US
2017 Q1	Alaska Airlines / Virgin America	AS/VX

Basic summary statistics for relevant observations can be found in table 4. Additionally, the summary statistics broken down by whether a merger was caught by no guidelines, 2023, or 2010 pre and post merger can be found in tables 5 through 10, respectively.

Table 4

Summary Statistics for All Observations in Regression

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.111	0.315	0	1
distance	1,354	659.8	36	3,864
numpass	1,105	4,319	100	137,180
mktshare	0.469	0.368	0.000484	1
avgfare	233.8	70.90	23.89	1,002

N = 1,867,777 for all variables

While there are some observations with very small distances such as 36 miles, and a market share as small as 0.04%, these markets make up very few observations and were still potentially relevant to the analysis, which is why I kept them.

The mean market share of uncaught observations is slightly greater than that of observations caught by the 2010 guidelines. While this difference is not statistically significant, it is still unexpected. The mean market share of observations caught by the 2023 guidelines is lower than these two. Another important difference to outline is that for uncaught observations, the mean average fare does slightly increase post-merger.

Table 5

Pre-Merger Summary Statistics for Markets Not Caught by 2010 or 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.125	0.331	0	1
distance	1,266	639.3	36	3,746
numpass	1,045	4,099	100	114,800
mktshare	0.527	0.370	0.000484	1
avgfare	221.8	70.16	23.89	1,002

N = 582,130 for all variables

Table 6

Post-Merger Summary Statistics for Markets Not Caught by 2010 or 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.0993	0.299	0	1
distance	1,390	670.0	55	3,864
numpass	1,002	3,989	100	137,180
mktshare	0.454	0.370	0.000563	1
avgfare	239.9	70.50	27.24	870.0

N = 1,141,514 for all variables

It is worth noting that the mean average fare for markets identified by the 2010 guidelines is slightly lower than that of those caught by the 2023 guidelines. Additionally, the average number of passengers served by each carrier is lower on routes caught by the 2023 guidelines than uncaught routes and routes caught by 2010.

Table 7

Pre-Merger Summary Statistics for Markets Caught by 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.00943	0.0966	0	1
distance	1,720	620.7	315	3,425
numpass	614.1	1,317	100	35,640
mktshare	0.138	0.0991	0.00309	1
avgfare	219.5	68.10	61.69	719.9

N = 15,168 for all variables

Table 8

Post-Merger Summary Statistics for Markets Caught by 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.00799	0.0890	0	1
distance	1,723	594.3	315.2	3,425
numpass	622.4	1,612	100	47,230
mktshare	0.138	0.103	0.00162	1
avgfare	238.3	69.01	64.32	722.5

N = 24,910 for all variables

In this analysis, connections greatly affect the result, and there are some significant differences between markets identified by the 2023 and 2010 guidelines, specifically in terms of connections, that are worth highlighting. A higher share of routes identified by the 2010 guidelines are nonstop routes, and, on average, the routes identified by the 2010 guidelines are shorter than those identified by the 2023 guidelines. Compared to uncaught routes, the 2023 guidelines catch more nonstop routes.

Table 9

Pre-Merger Summary Statistics for Markets Caught by 2010 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.245	0.430	0	1
distance	1,244	589.3	140	3,544
numpass	2,789	7,581	100	111,030
mktshare	0.421	0.295	0.000958	1
avgfare	223.8	71.01	49.84	731.7

N = 41,739 for all variables

Table 10

Post-Merger Summary Statistics for Markets Caught by 2010 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.178	0.382	0	1
distance	1,352	591.3	142.1	3,571
numpass	2,727	8,123	100	131,620
mktshare	0.438	0.306	0.00240	1
avgfare	243.4	70.64	59.48	749.2

N = 62,316 for all variables

Furthermore, the mean market share of markets identified by the 2023 guidelines is noteworthy. There is not a large difference between the mean market share in markets that are uncaught compared to markets that are caught by the 2023 guidelines. This is important as, theoretically, there would be a more significant gap between the means in these two categories.

Another variable to examine is the calculated change in HHI because of the merger. It is important to note that calculated change in HHI is only as a result of the merger. Other market

conditions may cause the HHI based on post-merger market shares to decrease; however, the change in HHI used to identify markets under presumption was calculated using pre-merger share. For this reason, all of the changes in HHI in the dataset are positive. Figure 2 depicts a scatter plot of the change in HHI against the post-merger HHIs to give a better visual of how significant the observed changes are. The red box represents the 2023 guidelines, and the blue box represents the 2010 guidelines.

Figure 2

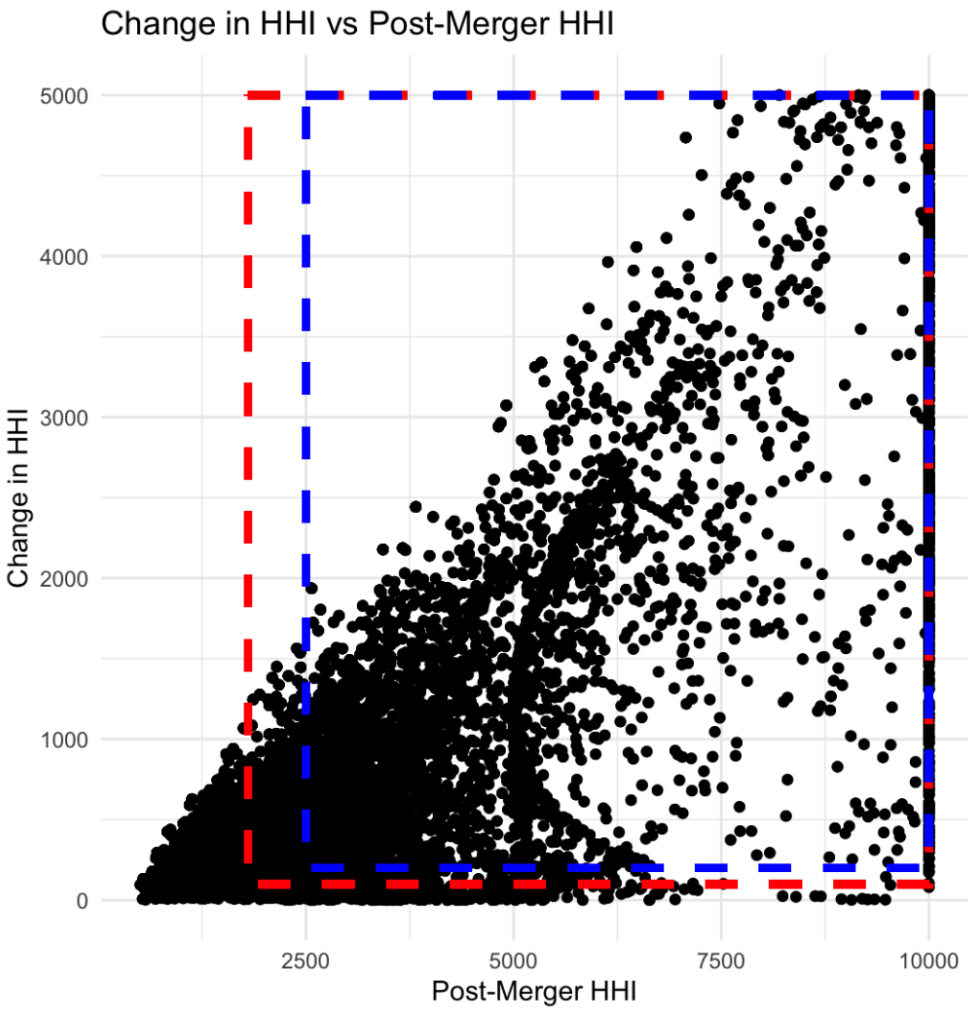


Table 11 and figure 3 below contain information about the proportion of observations that were caught by 2023, 2010, and neither set of guidelines, by each regression specification. While there were not many significant differences between them, one that is noteworthy is that when only considering connecting routes, slightly more markets were caught by the 2010 guidelines, and when only considering nonstop routes, slightly more markets were caught by the 2023 guidelines.

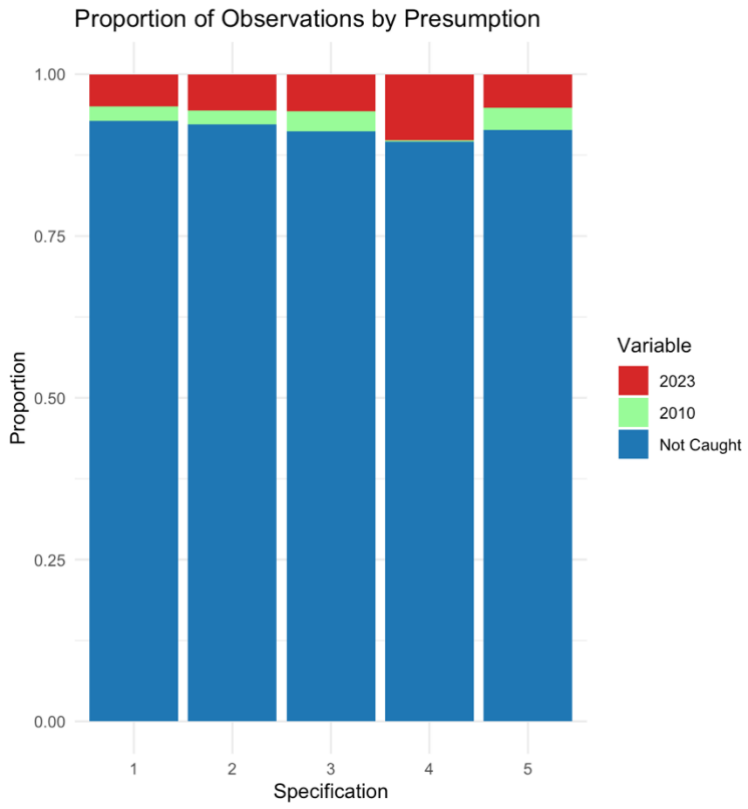
Table 11

Proportion of Observations Caught by Each Guidelines

	Regression 1	Regression 2	Regression 3	Nonstop	Connecting
Uncaught	0.928	0.923	0.912	0.896	0.914
2023	0.023	0.021	0.031	0.002	0.052
2010	0.049	0.056	0.057	0.102	0.034

Regression 1 defines a market as an origin/destination pair, regression 2 defines a market using connection as a categorical variable, and regression 3 defines a market using connection as a binary variable.

Figure 3



3.1 Methods

I use a difference in differences fixed effects model to estimate the effects of mergers caught by the 2010 and 2023 guidelines. There are two main explanatory variables, a dummy variable if a market would be identified by the 2010 guidelines and the 2023 guidelines, and a second for if a market would be identified by only the 2023 guidelines. It is worth noting that any merger caught by the 2010 guidelines, necessarily, will be caught by the 2023 guidelines as well.

In order to establish an effective observation period, observations were only kept if they were within 8 quarters before or 12 quarters after a relevant merger. This ensured that any observation would only be considered if it was relevant to the investigated merger.

The regression equation can be seen below.

$$\ln(WeightedAvgPrice_{rtc}) = \beta_0 + \beta_1(Caught2010_{rtc} * PostMerger_{rtc}) + \beta_2(Caught2023_{rtc} * PostMerger_{rtc}) + \alpha_1(Route)^{fe} + \alpha_2(Time)^{fe} + \alpha_3(Carrier/Merger)^{fe} + \varepsilon_{rtc}$$

An observation is a route *r* at a given time *t* from a specific carrier *c*

The response variable is the natural log of weighted average price. Weighted average price is defined as the average of the mean price of both merging carriers on the route, weighted by their market share on that route. In the model, there are two explanatory variables, an interaction between a dummy variable that identifies observations on routes that would be caught by the 2010 guidelines and a post-merger dummy variable, and an interaction between a dummy variable that identifies observations on routes that would be caught by only the 2023 guidelines and a post-merger dummy variable. Additionally, there are fixed effects on route, time, and carrier/merger[6]. Robust standard errors are used to avoid potential bias caused by heteroskedasticity. The variables identifying markets caught by the 2010 guidelines and the 2023 guidelines are mutually exclusive to assist with interpretation.

[6] Carrier/merger is used in place of carrier, as some carriers appear in multiple mergers in this dataset, and I wanted to denote which merger the route was affected by.

No controls were used in the regression. While there are factors that could affect prices over time such as fuel prices and major economic incidents, because there are quarterly fixed effects in the model, most of these changes would be accounted for.

With the data that has been filtered, this leaves the regression with five groups of observations. There are routes identified by the 2023 guidelines pre-merger, routes identified by the 2023 guidelines post-merger, those identified by the 2010 guidelines pre and post-merger, and routes where only one of the merging firms are present. The routes with only one present merging firm make up the comparison group, and the observed change in prices post-merger for routes identified by both sets of guidelines is the observed effect of the merger.

4 Results

The regressions were run with the previously mentioned specifications. The results are displayed below. For the initial specifications, markets that are caught by the 2010 guidelines, on average, are correlated with a 2.91% increase in weighted average price post-merger and markets that are caught by only the 2023 guidelines are correlated with a 2.39% increase in weighted average price post-merger, significant at all levels.

Table 12

Regression Estimating Change in Price

VARIABLES	(1) Connections Ignored	(2) Categorical	(3) Binary	(4) Nonstop	(5) Connecting
Caught2010	0.0291***	0.0114***	0.0150***	0.00746**	0.0176***
	(0.00135)	(0.00131)	(0.00130)	(0.00292)	(0.00145)
Caught2023	0.0239***	0.0226***	0.0179***	0.0233	0.0195***
	(0.00207)	(0.00204)	(0.00174)	(0.0289)	(0.00174)
Constant	5.409***	5.409***	5.410***	5.279***	5.427***
	(0.000122)	(0.000124)	(0.000126)	(0.000384)	(0.000133)
Observations	1,768,989	1,849,492	1,803,944	204,176	1,599,768
R-squared	0.760	0.748	0.751	0.813	0.733

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regression 1 defines a market as an origin/destination pair, regression 2 defines a market using connection as a categorical variable, and regression 3 defines a market using connection as a binary variable.

For the second set of specifications, markets that are caught by the 2010 guidelines, on average, are correlated with a 1.14% increase in weighted average price post-merger and markets that are caught by only the 2023 guidelines are correlated with a 2.26% increase in weighted average price post-merger, significant at all levels.

For the third set of specifications, markets that are caught by the 2010 guidelines, on average, are correlated with a 1.50% increase in weighted average price post-merger and markets that are caught by only the 2023 guidelines are correlated with a 1.79% increase in weighted average price post-merger, significant at all levels.

For nonstop markets, the effect is statistically insignificant for the 2023 guidelines, but for markets caught by the 2010 guidelines, there is an estimated 0.75% price increase, significant at the 5% level. Connecting markets caught by the 2010 guidelines, on average, saw a 1.76%

increase in prices, significant at all levels, and markets caught by the 2023 guidelines are correlated with a 1.95% increase in prices, significant at all levels.

The significant difference between the effect of both sets of guidelines on nonstop versus connecting routes is interesting. One could reasonably assume that passengers who purchase nonstop flights would be less sensitive to an increase in price, making it easier for carriers to raise prices. On the other hand, one could also assume that it would be more difficult to raise prices on connecting routes, as there are more close substitutes across carriers. The fact that connecting markets contained more of the price increase was unexpected.

A surprising result is that multiple sets of specifications estimate a larger price increase on markets identified by the 2023 guidelines than the 2010 guidelines. Given that the threshold for presumption under the 2023 guidelines is lower than that of the 2010 guidelines, the expectation was that those markets would see a lower price increase. Perhaps the relationship between HHI and price is not linear, and firms with significant market shares in markets with extremely high HHI's may be able to take advantage of economies of scale or other market dynamics to actually decrease prices or increase prices less. Nevertheless, this relationship was surprising and noteworthy.

Ultimately, these results provide compelling insight into the overall effect of both the old and new guidelines on prices. The 2010 and 2023 guidelines consistently identify markets with slight estimated price increases; however, this effect is observed mostly on connecting routes.

Aside from the type of route, another important factor potentially affecting prices are the specific merging carriers and their presence, therefore regressions were run estimating results by merger. It is worth noting that the regression was only possible for seven of the mergers, as there

was not enough overlap to produce a result in other mergers. This regression was run under the second specification, which defined markets using connection as a categorical variable.

Table 13

Regression Estimating Change in Price by Merger

VARIABLES	(1) AA/QQ	(2) US/HP	(3) DL/NW	(4) UA/CO	(5) WN/FL	(6) AA/US	(7) AS/VX
Caught2010	-0.0265***	0.0113*	0.0421***	0.0423***	0.0664***	0.0120***	-0.0589***
	(0.00418)	(0.00603)	(0.00215)	(0.00341)	(0.00433)	(0.00222)	(0.0136)
Caught2023	-0.0492***	0.0300***	0.0963***	0.0295***	0.0160	0.0412***	0.0747***
	(0.00460)	(0.00609)	(0.00360)	(0.00341)	(0.00991)	(0.00257)	(0.0209)
Constant	5.317***	5.269***	5.439***	5.483***	5.360***	5.559***	5.387***
	(0.000446)	(0.000397)	(0.000270)	(0.000279)	(0.000190)	(0.000219)	(0.000644)
Observations	176,908	206,794	349,043	248,444	229,166	373,268	34,973
R-squared	0.770	0.737	0.777	0.788	0.865	0.734	0.811

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The regression results are, relatively surprisingly, very heterogenous. Only the UA/CO and US/HP mergers saw the expected effects. The price change on other mergers was either much higher or much lower than expected. One minor takeaway is that the three largest mergers in the dataset, DL/NW, UA/CO, and AA/US saw some of the largest price increases. This suggests that overall presence of the carrier may impact how prices change, but that is just a hypothesis. Overall, due to the heterogeneity of these results, there are few takeaways that can be drawn from them.

A regression was also run examining output. This regression had the exact same specifications, except the output variable was the natural log of total passengers instead of price. The results can be seen in table 14. The estimated change in output in markets that fall under the

presumption of the 2023 guidelines is a decrease of a little over 2%. This is observed on all specifications except nonstop routes. This result, along with the estimated price increase observed in these markets, does suggest that the 2023 guidelines are effective at identifying markets where mergers will harm consumers.

The estimated decrease in output, however, in markets caught under the 2010 guidelines is much more sensitive to how markets are defined. On nonstop routes, the observed change in output is effectively 0, however on all routes the effect ranges from -0.7% to -3.68%, depending on the specification. This would also suggest that the 2010 guidelines are effective at identifying markets where mergers will harm consumers.

Table 14

Regression Estimating Change in Output

VARIABLES	(1) Connections Ignored	(2) Categorical	(3) Binary	(4) Nonstop	(5) Connecting
Caught2010	-0.0368***	-0.00770***	-0.0166***	0.000574	-0.0204***
	(0.00311)	(0.00263)	(0.00273)	(0.00473)	(0.00315)
Caught2023	-0.0209***	-0.0213***	-0.0208***	-0.132***	-0.0232***
	(0.00380)	(0.00367)	(0.00324)	(0.0342)	(0.00325)
Constant	7.722***	7.794***	7.765***	9.056***	7.600***
	(0.000270)	(0.000257)	(0.000268)	(0.000669)	(0.000289)
Observations	1,768,989	1,849,492	1,803,944	204,176	1,599,768
R-squared	0.967	0.970	0.969	0.968	0.966

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

An additional regression examining output was run for each merger, but the results were similarly heterogenous to the price effects of each merger, so I decided not to include it in the paper.

4.1 Robustness

A concern identified during the analysis was the issue of close airports. One could reasonably suggest that flying into, say, JFK or flying into LGA[7] are substitutes, and this would not allow a carrier to exert the same effect on prices as not having a close substitute. For this reason, I chose to run additional regressions with close airports combined[8]. The regressions run with close airports combined were run under the second set of specifications where markets are identified using connection as a categorical variable.

The regression results with changes for close airports can be seen below. For the first set of results, a new variable was defined to determine "city", which was the same as the airport for all observations except airports that are close, where a different value was given for each city. For the second regression, any observations with either an origin or destination as one of the cities with multiple close airports were dropped.

[7] JFK and LGA are airports in New York City, separated by about 10 miles (Blade.com, 2023)
[8] "Close Airports" were identified using the adjacent airports in Brueckner et. al, 2013b and Luo, 2013. Table 16 displays which airports are affected.

Table 15

VARIABLES	(1) Combined	(2) Dropped
Caught2010	0.0294***	0.0246***
	(0.00152)	(0.00178)
Caught2023	0.0138***	0.0328***
	(0.00191)	(0.00258)
Constant	5.410***	5.408***
	(0.000120)	(0.000157)
Observations	1,767,268	1,106,965
R-squared	0.760	0.751

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These results suggest a similar effect on prices by mergers identified by both sets of guidelines compared to the initial regressions. This signifies that the routes affected by these changed specifications do not have an extremely significant effect on the result. Given that some of the airports that are affected by this change are LAX, DFW, JFK, and ORD, among other high-traffic airports, one could assume that combining or dropping these observations would have a significant effect on the estimated price increase. There is a slight difference in the estimated effect on markets identified by the 2023 guidelines which does suggest large airports may have smaller price increases than other airports.

5 Conclusion

Overall, this paper does suggest that both the 2023 guidelines and 2010 guidelines are successful at identifying markets that will see price increases post-merger; furthermore, the subsequent decrease in output suggests that mergers in markets that fall under the threshold for

presumption under the 2010 and 2023 guidelines have a negative effect on consumer welfare.

Moreover, one could argue that, assuming the 2010 guidelines are effective at identifying anticompetitive markets, finding a similar estimated result for both sets of guidelines would suggest that the 2023 guidelines are also effective at identifying anticompetitive markets, as long as price increase and effects on competition are related.

With a difference in differences model, I estimate that routes identified by the 2010 guidelines see, on average, between a 1.14% and 2.91% increase in prices post-merger. Additionally, I estimate that routes identified by the 2023 guidelines see a slight increase in prices, which ranges from 0.75% to 2.39%, depending on how connections are specified.

An important aspect of the estimated effect of markets caught by the 2023 guidelines is that it may be highly driven by connecting routes. Due to this, it may be necessary to determine a better method for defining connections for analysis, that is not as broad as defining any flight with the same origin and destination and a connection as the same route, but also not defining every single route with a different connection differently. Perhaps a model that considers how consumers view connecting flights would give better insight into this effect.

This result is a good first step into determining what effect the 2023 merger guidelines will have in the future, but more research is required on this topic. Specifically, more research into factors such as output or margins that would give more insight into whether the merged carriers are exhibiting anticompetitive behavior in this industry. Additionally, finding a better method of defining a “market” that is more consistent with consumer and firm behavior could improve the estimate in this research.

Ultimately, the 2023 merger guidelines and 2010 merger guidelines both effectively identify routes with price increases, and using this information to inform decisions about mergers

in the airline industry and other industries may be able to better predict which markets are likely to see price increases after a merger.

Tables and Figures

Table 1

Authors	Year	Merger	Control Group	Result
Dennis Carlton, Mark Israel, Ian MacSwain, Eugene Orlov	2017	DL/NW	Routes where there was not overlap prior to the merger	4.4% price decrease on nonstop routes, 3.7% price decrease on connecting routes
Dennis Carlton, Mark Israel, Ian MacSwain, Eugene Orlov	2017	UA/CO	Routes where there was not overlap prior to the merger	1.3% price decrease on nonstop routes, 3.6% price increase on connecting routes
Dennis Carlton, Mark Israel, Ian MacSwain, Eugene Orlov	2017	AA/US	Routes where there was not overlap prior to the merger	12.3% price decrease on nonstop routes, 1% price increase on connecting routes
Huubin B. Le	2016	WN/FL	Routes where neither airline competed prior to merger	7.68% price increase
Dan Luo	2014	DL/NW	Routes where there was not overlap prior to the merger	5.1% price increase on nonstop routes

Table 2

Carrier	RouteID	NumPass	MktPass	MktShare	PreHHI	DeltaHHI	PostHHI
AA	JFK_MIA_Nonstop	31160	54390	0.573	4942.06	240.66	5182.72
US	JFK_MIA_Nonstop	1130	54390	0.021	4942.06	240.66	5182.72
DL	JFK_MIA_Nonstop	22100	54390	0.406	4942.06	N/A	5182.72

Table 3

Time of Merger	Merger	IATA Codes
1999 Q2	American Airlines / Reno Air	AA/QQ
2001 Q3	American Airlines / Trans World Airlines	AA/TW
2005 Q4	US Airways / America West Airways	US/HP
2010 Q1	Delta Airlines / Northwest Airlines	DL/NW
2011 Q1	United Airlines / Continental Airlines	UA/CO
2011 Q2	Southwest Airlines / Airtran Airways	WN/FL
2014 Q1	American Airlines / US Airways	AA/US
2017 Q1	Alaska Airlines / Virgin America	AS/VX

Table 4

Summary Statistics for All Observations in Regression

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.111	0.315	0	1
distance	1,354	659.8	36	3,864
numpass	1,105	4,319	100	137,180
mktshare	0.469	0.368	0.000484	1
avgfare	233.8	70.90	23.89	1,002

N = 1,867,777 for all variables

Table 5

Pre-Merger Summary Statistics for Markets Not Caught by 2010 or 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.125	0.331	0	1
distance	1,266	639.3	36	3,746
numpass	1,045	4,099	100	114,800
mktshare	0.527	0.370	0.000484	1
avgfare	221.8	70.16	23.89	1,002

N = 582,130 for all variables

Table 6

Post-Merger Summary Statistics for Markets Not Caught by 2010 or 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.0993	0.299	0	1
distance	1,390	670.0	55	3,864
numpass	1,002	3,989	100	137,180
mktshare	0.454	0.370	0.000563	1
avgfare	239.9	70.50	27.24	870.0

N = 1,141,514 for all variables

Table 7

Pre-Merger Summary Statistics for Markets Caught by 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.00943	0.0966	0	1
distance	1,720	620.7	315	3,425
numpass	614.1	1,317	100	35,640
mktshare	0.138	0.0991	0.00309	1
avgfare	219.5	68.10	61.69	719.9

N = 15,168 for all variables

Table 8

Post-Merger Summary Statistics for Markets Caught by 2023 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.00799	0.0890	0	1
distance	1,723	594.3	315.2	3,425
numpass	622.4	1,612	100	47,230
mktshare	0.138	0.103	0.00162	1
avgfare	238.3	69.01	64.32	722.5

N = 24,910 for all variables

Table 9

Pre-Merger Summary Statistics for Markets Caught by 2010 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.245	0.430	0	1
distance	1,244	589.3	140	3,544
numpass	2,789	7,581	100	111,030
mktshare	0.421	0.295	0.000958	1
avgfare	223.8	71.01	49.84	731.7

N = 41,739 for all variables

Table 10

Post-Merger Summary Statistics for Markets Caught by 2010 Guidelines

VARIABLES	(1) mean	(2) sd	(3) min	(4) max
nonstop	0.178	0.382	0	1
distance	1,352	591.3	142.1	3,571
numpass	2,727	8,123	100	131,620
mktshare	0.438	0.306	0.00240	1
avgfare	243.4	70.64	59.48	749.2

N = 62,316 for all variables

Table 11

Proportion of Observations Caught by Each Guidelines

	Regression 1	Regression 2	Regression 3	Nonstop	Connecting
Uncaught	0.928	0.923	0.912	0.896	0.914
2023	0.023	0.021	0.031	0.002	0.052
2010	0.049	0.056	0.057	0.102	0.034

Table 12

Regression Estimating Change in Price

VARIABLES	(1) Connections Ignored	(2) Categorical	(3) Binary	(4) Nonstop	(5) Connecting
Caught2010	0.0291***	0.0114***	0.0150***	0.00746**	0.0176***
	(0.00135)	(0.00131)	(0.00130)	(0.00292)	(0.00145)
Caught2023	0.0239***	0.0226***	0.0179***	0.0233	0.0195***
	(0.00207)	(0.00204)	(0.00174)	(0.0289)	(0.00174)
Constant	5.409***	5.409***	5.410***	5.279***	5.427***
	(0.000122)	(0.000124)	(0.000126)	(0.000384)	(0.000133)
Observations	1,768,989	1,849,492	1,803,944	204,176	1,599,768
R-squared	0.760	0.748	0.751	0.813	0.733

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13

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VARIABLES	(1) AA/QQ	(2) US/HP	(3) DL/NW	(4) UA/CO	(5) WN/FL	(6) AA/US	(7) AS/VX
Caught2010	-0.0265***	0.0113*	0.0421***	0.0423***	0.0664***	0.0120***	-0.0589***
	(0.00418)	(0.00603)	(0.00215)	(0.00341)	(0.00433)	(0.00222)	(0.0136)
Caught2023	-0.0492***	0.0300***	0.0963***	0.0295***	0.0160	0.0412***	0.0747***
	(0.00460)	(0.00609)	(0.00360)	(0.00341)	(0.00991)	(0.00257)	(0.0209)
Constant	5.317***	5.269***	5.439***	5.483***	5.360***	5.559***	5.387***
	(0.000446)	(0.000397)	(0.000270)	(0.000279)	(0.000190)	(0.000219)	(0.000644)
Observations	176,908	206,794	349,043	248,444	229,166	373,268	34,973
R-squared	0.770	0.737	0.777	0.788	0.865	0.734	0.811

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14

Regression Estimating Change in Output

VARIABLES	(1) Connections Ignored	(2) Categorical	(3) Binary	(4) Nonstop	(5) Connecting
Caught2010	-0.0368***	-0.00770***	-0.0166***	0.000574	-0.0204***
	(0.00311)	(0.00263)	(0.00273)	(0.00473)	(0.00315)
Caught2023	-0.0209***	-0.0213***	-0.0208***	-0.132***	-0.0232***
	(0.00380)	(0.00367)	(0.00324)	(0.0342)	(0.00325)
Constant	7.722***	7.794***	7.765***	9.056***	7.600***
	(0.000270)	(0.000257)	(0.000268)	(0.000669)	(0.000289)
Observations	1,768,989	1,849,492	1,803,944	204,176	1,599,768
R-squared	0.967	0.970	0.969	0.968	0.966

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15

VARIABLES	(1) Combined	(2) Dropped
Caught2010	0.0294***	0.0246***
	(0.00152)	(0.00178)
Caught2023	0.0138***	0.0328***
	(0.00191)	(0.00258)
Constant	5.410***	5.408***
	(0.000120)	(0.000157)
Observations	1,767,268	1,106,965
R-squared	0.760	0.751

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16

City	**Affected Airports**
Chicago	ORD, MDW
Cincinnati	CVG, DAY
Cleveland	CLE, CAK
Dallas	DFW, DAL
Houston	IAH, HOU
Los Angeles	LAX, BUR, LGB
Miami	MIA, FLL
New York	LGA, EWR, JFK
San Francisco	SFO, OAK
Tampa	TPA, PIE
Washington, DC	DCA, IAD, BWI

Figure 1

Maps depicting the three described routes (retrieved from greatcirclemap.com

Figure 2

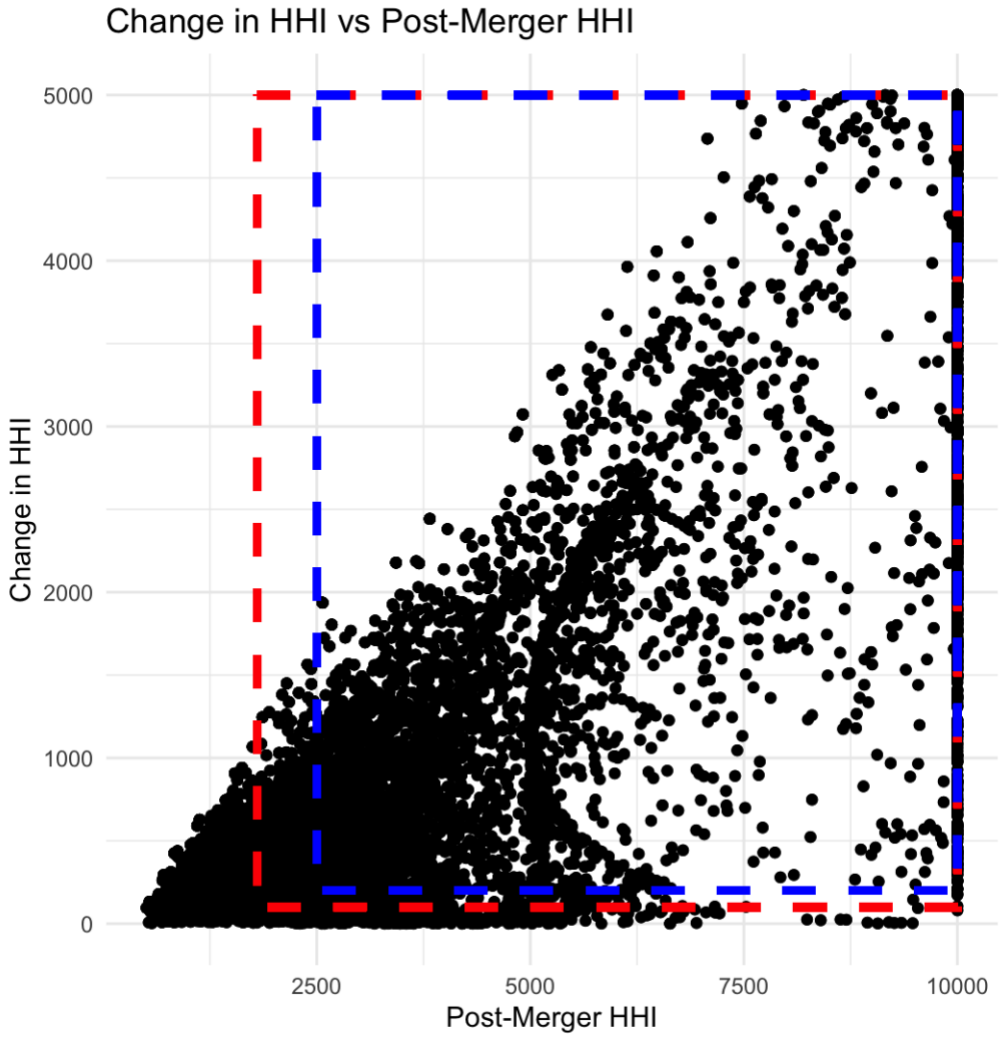
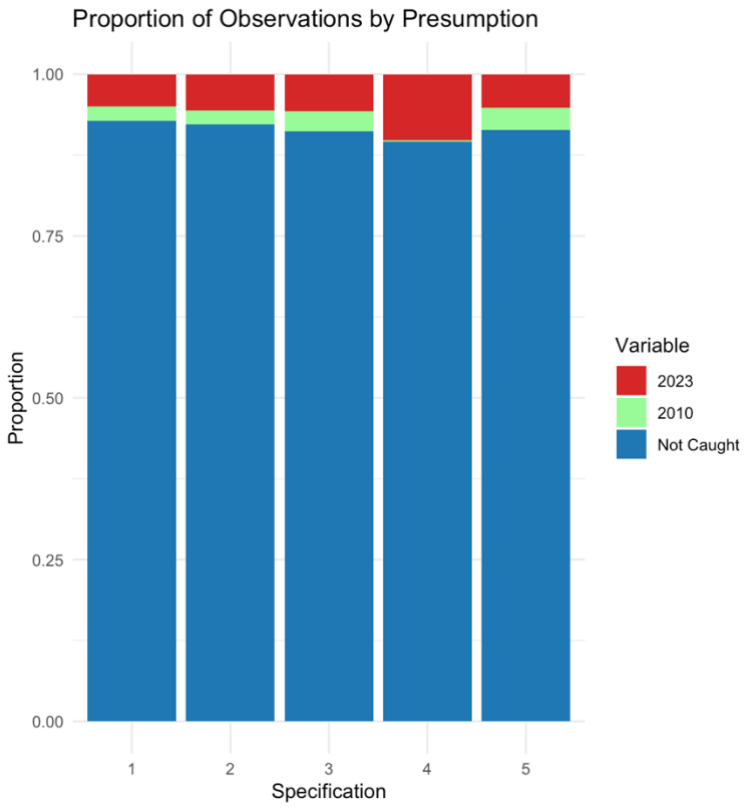


Figure 3


Proportion of Observations by Presumption
1.00
0.75
0.50
0.25
0.00
Proportion
1
2
3
4
5
Specification
Variable
2023
2010
Not Caught

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