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An Ex Post Analysis of the US Airways/American Airlines Merger

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Abstract This paper investigates the price and output effects of the US Airways and American Airlines merger in markets in which actual or potential competition was eliminated. In markets in which actual competition was eliminated, the results are mixed. The merger is procompetitive (lower prices and higher output) in nonstop markets in which both endpoints are major hubs of merging airlines, but anticompetitive in connecting markets. Where potential competition was eliminated, the results are consistent with significant price increases and output reductions, particularly when the potential competitor was US Airways.

Keywords: airline merger; market competition

JEL Classification Codes: L11, L40, L93

1 Introduction

The merger between US Airways (US) and American Airlines (AA) in 2013 was initially challenged by federal antitrust authorities because it was considered harmful to market competition. According to the US Department of Justice (DOJ), the merger would eliminate significant actual and potential competition between the airlines and would most likely lead to higher prices and lower output (DOJ 2013). Even though this merger was ultimately approved on the condition that the airlines gave up slots and gates at certain airports to other, low-cost carriers[1] (LCCs), it is not clear whether the adverse impact on price and output from the loss of actual and potential competition was alleviated. This paper investigates the price and output effects of the US/AA merger in markets in which actual or potential competition was eliminated.

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[1] Several studies have documented stronger competitive effects of LCCs' market presence and entry than of network airlines' market presence and entry (Morisson 2001; Kwoka, Hearle, and Alepin 2016).

Retrospective analyses of airline mergers tend to focus only on the price effects in markets in which the airlines previously competed (Jain 2015; Luo 2014). This paper differs in three aspects that could potentially allow it to provide additional insights into the effects of a merger. First, the focus is on output in addition to price. Together, the two dimensions provide a fuller picture of the competitive effects of the merger and allow us to comment on overall consumer welfare (Richard 2003; Werden et al. 1991). Second, traditional analysis usually considers all competing markets to be the same. However, it is likely that the merging airlines exert different market-power and efficiency effects depending on the type of competing market. This paper makes a distinction between hub and non-hub in the analysis of competing markets. It is well known that network airlines use hubs to maximize traffic flows (Brueckner and Spiller 1994). The merging of those hub operations in markets in which they compete can potentially affect the firms' market power and efficiencies differently relative to operations in competing non-hub markets. Third, we also evaluate markets in which potential competition is eliminated. As Kwoka and Shumilkina (2010) and Le (2016) have documented, mergers that eliminate potential competition have a significant adverse effect on price and output. The US/AA merger is particularly concerning in this respect because the number of markets with potential competition is much larger than the number of markets with actual competition, suggesting that the potential adverse effects can be serious.

The analysis yields two main findings. First, there are significant procompetitive effects in markets in which actual competition was eliminated, particularly where both endpoints of these markets are major hubs of the merging airlines. Much harm however comes from connecting routes in non-hub and one-hub markets. Second, the loss of potential competition is harmful for price and output overall, but the harm is greater in markets associated with US Airways hubs or markets in which it was the potential competitor.

These findings suggest that even though this merger is procompetitive in markets in which actual competition was eliminated, it is important to distinguish between hub and non-hub markets because not all effects are procompetitive. With respect to potential competition, this merger has been quite harmful. Given that there are almost twice as many markets with potential competition as markets with actual competition, the harm is more serious.

In prospective evaluation of airline mergers, policy makers are often more concerned about the elimination of actual competition than potential competition. In addition, consideration of efficiencies has to be merger-specific and verifiable. These findings however suggest that eliminating potential competition can be more serious than eliminating actual competition but that merger-specific efficiencies can come from competing markets associated with the airlines' major hubs.

The rest of the paper is organized as follows: The next section describes the data, then presents descriptive statistics of the affected markets and the empirical model. Section 3 discusses the baseline results, performs several variations and sensitivity checks. Section 4 concludes.

2 Data, Descriptive Statistics, and Model

2.1 Data

The main dataset is the Airline Origin and Destination Survey (DB1B) collected by the Bureau of Transportation Statistics. This survey is released quarterly and represents a 10 percent sample of domestic airline tickets reported by the carriers. The unit of analysis is at the *route-carrier-quarter-year*[2] level, where a *route* is defined as a combination of the origin airport, destination airport, and any connections. An airline *market* is defined as a unidirectional combination of the origin airport and destination airport. An example of a ticket is AA: JFK-ORD-LAX, where the passenger is flying with American Airlines (AA) departing from New York (JFK) to Los Angeles (LAX) with a connection in Chicago (ORD). In this case, the airline market is New York-Los Angeles (JFK-LAX) but the route is a connecting route (JFK-ORD-LAX). If US competed with AA in this market prior to their merger, then this market is affected by the merger because it eliminates US as a direct competitor to AA. Defining an airline market this way is common in the literature. Information on the identities of the merging airlines and the origins and destinations they serve allows us to identify all markets affected by the merger. Several standard filters are applied to the data: ticket prices that are unreliable, missing, less than $25, or greater than $1,500 are excluded; itineraries associated with Alaska or Hawaii are excluded; only coach-class tickets are included; routes with less than twenty passengers are excluded; and prices for roundtrip tickets are divided by two.

As suggested by Carlton et al (2019), the selection of the pre- and postmerger windows should reflect periods of independent decision-making. For the pre-merger period, we use the first and second quarters of 2012. Since talks of the US/AA merger did not start until August 31, 2012, and the boards of both airlines did not approve the merger until February 13, 2013, the chosen pre-merger periods should be before August 31, 2012. The merger process took about two-and-a-half years to complete. On October 17, 2015, US flew its last flight and officially retired its brand to complete its integration with AA. For the postmerger period, we use the first and second quarters of 2016.

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[2] There are three carriers reported in the data—reporting carrier, ticketing carrier, and operating carrier. The analysis uses the operating carrier because this is the airline that actually transports the passengers. The reporting carrier submits the ticket information to the Office of Airline Information and ticketing carrier the airline that issues the flight reservation.

2.2 Markets Affected by the Merger

The relationship between the merging airlines and the markets they serve can be categorized as follows: (i) *Actual* markets are markets served by American and US Airways prior to their merger. (ii) *Potential* markets are markets served by American or US Airways with the other being a potential competitor. A potential competitor does not serve the market but is present at one or both endpoints of the market. Hence, the merger will eliminate one of the airlines as the potential competitor. Because they do not directly compete in these markets, the number of actual competitors is unchanged. (iii) *None* refers to markets served by American or US Airways but in which there is no potential competition from the other. While these markets are related to the airlines, they are unaffected by the merger because actual or potential competition is unchanged. (iv) *Control* markets are markets that neither American nor US Airways serves. These markets are unaffected by the merger and unrelated to the airlines.

Table 1 summarizes these variables and provides the number of markets related to each category as well as the mean market price and number of passengers. US and AA directly compete in 3,254 markets with an average price of $166 and 210 passengers per market. There are almost twice as many markets with potential competition: 6,326. Even though the mean number of passengers is greater in actual markets, in aggregate there are more passengers in potential markets, suggesting the merger has a larger effect in such markets than in actual markets for the same change in price.

Table 1: Number of Markets Affected by the Merger

Variables	Definitions	No. of markets	Mean market price	Mean number of passengers
ACTUAL	American and US Airways overlap markets	3,254	$166.30	210.22
POTENTIAL	American or US Airways with other potential	6,326	$166.04	118.82
NONE	American or US Airways with no potential	47	$151.49	75.91
CONTROL	Neither American nor US Airways	7,544	$159.97	122
TOTAL		17,171	$162.54	140

2.3 Empirical Model

The baseline reduced-form model is as follows:

$$\ln (y_{ijt}) = \beta_0 + \beta_1 post_t + \beta_2 post_t \times ACTUAL_m + \beta_3 post_t \times POTENTIAL_m$$
$$+ \beta_4 post_t \times NONE_m + X\beta_{controls} + \eta_{ij} + \nu_t + \varepsilon_{ijt} \quad (1)$$

The dependent variable y_{ijt} is either p_{ijt} for the price regression or q_{ijt} for the output regression, where p_{ijt} is the ticket price on route *i* served by carrier j at time *t* and q_{ijt} is the total number of passengers traveling on *ijt*. Market dummy variables for actual and potential competition are denoted as $ACTUAL_m$ and $POTENTIAL_m$. The dummy variable $post_t$ indicates the postmerger period. The excluded dummy variable is $CONTROL_m$. The estimates β_2 and β_3 isolate the price and output effects of the merger in markets in which actual and potential competition are eliminated. Since $NONE_m$ comprises markets related to the merging airlines in which no potential or actual competition is affected, the estimate β_4 is expected to be statistically insignificant. The variable *X* is a vector of additional controls:

(i) Market concentration measured by the Herfindahl-Hirschman Index (*HHI*). The calculation of *HHI* holds the market shares of the merging carriers fixed at the pre-merger level. Any changes in *HHI* after the merger are due to changes in the shares of the nonmerging carriers.

(ii) *hub* (hub size) counts number of airports that the carrier connects with the origin airport of a market. The presence of an airline in a market is considered more dominant if the airline connects with a large number of other airports.

(iii) *pop* (market size) is the geometric mean of the market's population.

(iv) *income* is the geometric mean of the market's per capita income[3].

(v) *distance* is the nonstop distance (in miles) between the origin and destination airports.

(vi) *nonstop* indicates that the route has zero connections.

(vii) *tourist* (tourist destinations) indicates markets associated with Florida or Nevada.

(viii) *slot* indicates airports associated with John F. Kennedy, LaGuardia, or Reagan National.

(ix) Route-carrier fixed effects and time fixed effects are η_{ij} and ν_t.

Before estimating equation (1), we need to verify that the common-trend assumption holds, because the difference-in-difference approach requires of the control markets $CONTROL_m$ that (i) they are unrelated to the merger and the airlines; and (ii) their pre-merger price and output trends are similar to those of the affected markets. To test for this common trend, the following fixed-effects model is estimated in which the pre-merger time trend, $pretrend_t$, is interacted with the relevant markets' dummy variables:

[3] Population and income statistics are from the US Bureau of Economic Analysis.

$$\ln(y_{ijt}) = \alpha_0 + \alpha_1 pretrend_t + \alpha_2 pretrend_t \times ACTUAL_m$$
$$+\alpha_3 pretrend_t \times POTENTIAL_m + \alpha_4 pretrend_t \times NONE_m + \lambda_{ij} + \mu_{ijt} \quad (2)$$

Equation (2) is estimated using the pre-merger data. Since $CONTROL_m$ are the excluded markets, estimates α_2 and α_3 indicate how price and output trends in actual and potential markets are changing in relation to those in control markets. If their trends are in common with the control, these estimates should be statistically insignificant. The results are presented in table 2. On average, price and output in the control markets are increasing about 2.4 percent and 12.7 percent per quarter. Estimates for actual and potential markets are close to zero and not statistically significant, suggesting that price and output trends in those markets do not differ from those of the control. These results suggest that the control markets are likely to be reasonable candidates to help account for common changes that are unrelated to the merger.

3. Estimation Results

This section discusses the baseline results and variations to the model including (i) the distinction between hub and non-hub overlap markets; (ii) the identity and presence of the potential competitor; and (iii) the differences between nonstop and connecting routes. Based on the Hausman test, the fixed-effects (FE) model is preferred. The FE model controls for all time-invariant variables, but results of the random-effects (RE) model are also included to allow for the inclusion of these variables and for comparison with the FE estimates.

3.1 Baseline Results

Table 3 reports price and output estimates and their standard errors side by side for ease of comparison. Estimates on *post* are quite similar for the two models in the price regression but slightly different in the output regression. They suggest that after the merger, price and output in markets not affected by the merger (control markets) increase about 17 percent[4] and 23 percent.

We now turn to the effects of the merger in markets with actual competition between AA and US. Estimates on the variable post*ACTUAL suggest that relative to the control markets, price increases about 3.2 percent (t=3.56) and output decreases about 8 percent (t=4.87). The direction of price and output changes and their statistical significance strongly suggest that the merger is anticompetitive in these markets because a

[4] Since FE is the preferred model, we will use those estimates to calculate percentage changes, which is $100(e^{.160} - 1)$.

Table 2: Common-Trend Test

Variable	$\ln(p)$		$\ln(q)$	
	Estimate	SE	Estimate	SE
pretrend	.024*	.010	.127**	.012
*pretrend*ACTUAL*	.007	.011	.002	.014
*pretrend*POTENTIAL*	.001	.012	.022	.015
*pretrend*NONE*	-.101	.108	-.094	.127
constant	4.86**	.006	4.21**	.008
$\bar{R}^2$	.44		.88	

Note: Standard errors are clustered at the route-carrier level. *p<.05, **p<.01

competing airline is eliminated. The magnitudes of these estimates are also noteworthy. Even though the price increases for this merger are modest compared to previous mergers, which saw an average increase of about 6.5 percent (Kwoka 2015), the larger percentage decrease in output indicates that the adverse effects on consumer welfare are likely to be sizeable in aggregate.

In markets in which potential competition is eliminated, estimates on the variable *post*POTENTIAL* suggest that price also increases (4.3 percent, t=4.33) and output also decreases (6.3 percent, t=3.61). These results suggest that the merger is also anticompetitive in these markets even though neither market concentration nor the number of actual competitors has changed; the merger simply eliminates the threat of entry by one of the airlines. While not identical, the sizes of these estimates are similar to those for actual competition. Statistical tests on these estimates indicate that they are not statistically different, suggesting that eliminating potential competition for this merger is just as severe as eliminating actual competition. Given that the number of markets with potential competition is almost twice that of markets with actual competition, the adverse effects in aggregate are certainly larger. While one might expect that the effects of eliminating potential competition should be less than eliminating actual competition, these results are in part due to combining nonstop and connecting routes. We will make this distinction and other variations in later sections.

For markets without actual or potential competition, estimates on the variable *post*NONE* are not statistically significant, as expected. Although these estimates may not seem relevant for the current analysis, they are important because they provide evidence that what we found on actual and potential competition is most likely due to greater market power and not higher costs; if costs had risen, we would most likely see higher prices and lower output in these markets as well.

Table 3: Baseline Regression Results on Price and Output

Variable	RE $\ln(p)$	FE $\ln(p)$	RE $\ln(q)$	FE $\ln(q)$
post	.150**	.160**	.182**	.210**
	(.009)	(.015)	(.018)	(.027)
*post*ACTUAL*	.032**	.032**	−.061**	−.083**
	(.006)	(.009)	(.011)	(.017)
*post*POTENTIAL*	.041**	.042**	−.036**	−.065**
	(.006)	(.009)	(.012)	(.018)
*post*NONE*	.082+	−.001	.100	.140
	(.048)	(.080)	(.101)	(.156)
ACTUAL	−.099**		.285**	
	(.006)		(.016)	
POTENTIAL	−.073**		.171**	
	(.005)		(.013)	
NONE	−.132**		.216**	
	(.031)		(.075)	
ln(*HHI*)	−.007*	.027*	.061**	.076**
	(.003)	(.010)	(.010)	(.023)
hub	.002**	.002**	.002**	.001+
	(.0001)	(.0002)	(.0002)	(.0005)
ln(*pop*)	−.022	−.056	−.255**	−.219
	(.060)	(.099)	(.120)	(.178)
ln(*income*)	−.157	−.342	−1.67**	−1.84**
	(.207)	(.346)	(.431)	(.643)
ln(*distance*)	.281**		−.351**	
	(.003)		(.011)	
nonstop	−.090**		1.17**	
	(.003)		(.015)	
tourist	−.131**		.214**	
	(.0128)		(.040)	
slot	−.072		−.159	
	(.071)		(.245)	
constant	5.09*	9.02*	24.83**	26.28**
	(2.33)	(3.93)	(4.83)	(7.26)
$\bar{R}^2$	.30	.42	.40	.82

Note: Hausman test favors the fixed-effects model. Standard errors are clustered at the route-carrier level. Fixed effects for carrier, origin airport, destination airport, and quarter are included in the RE model. +p<.10, *p<.05, **p<.01

3.2 Hub Presence and Ownership

This section investigates two variations with respect to actual competition: (i) how it affects hub markets and non-hub markets; and (ii) whether there is a difference when AA is the hub owner versus US as the hub owner[5]. The effects of the merger can be pro- or anticompetitive in hub markets because even though the merger eliminates an actual competitor, it can also lead to greater efficiency and traffic flows from optimizing the airlines' combined hub networks. A hub market is defined as follows:

(1) *ACTUAL_1HUB* is a competing market in which the origin airport *or* destination airport of the market is a hub associated with either AA or US. In this case, only one of the market's endpoints is a hub airport.
(2) *ACTUAL_2HUB* is a competing market in which the origin airport *and* destination airport are hubs associated with either AA or US. Both endpoints are hub airports in this case. Making a distinction between one- and two-hub markets is potentially important because the distinction may influence how the merger affects traffic, cost, and competition.
(3) *ACTUAL_0HUB* is a competing market in which neither the origin nor destination airport is a hub. This variable indicates non-hub markets.

The first two columns of table 4 report the FE results. The effects on price are statistically insignificant for both one- and two-hub markets. The effects on output however differ. Output decreases about 6 percent (t=2.84) in markets with one hub but increases 16.4 percent (t=2.59) in markets in which both endpoints are hub airports. The increase in output suggests the merger is not anticompetitive in these two-hub markets even though one of the airlines is eliminated, suggesting in turn that efficiencies gains from hub optimization likely outweigh the increase in market power. Most of the anticompetitive effects of the merger are coming from one-hub markets and non-hub markets; perhaps efficiencies are less likely there. These results suggest the importance of including output in a merger analysis and suggest that the type of actual market is an important determinant of the competitive effects of a merger.

The second variation is on whether the identity of the airline that owns the hub matters. While the hub owner is often considered the stronger competitive force in a market, its competitive effects may not be symmetric.

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[5] US Airways hubs include Charlotte Douglas, Philadelphia International, Phoenix–Sky Harbor, and Reagan National. American hubs a are Charlotte Douglas, Philadelphia International, Phoenix–Sky Harbor, Reagan National, Chicago–O'Hare, Dallas/Fort Worth, Los Angeles, Miami, New York, and LaGuardia.

Table 4: Hub Presence and Ownership

	1 vs 2 HUB		US vs AA HUB	
Variable	ln(p)	ln(q)	ln(p)	ln(q)
*post*ACTUAL_1HUB*	.011	−.062**		
	(.011)	(.022)		
*post*ACTUAL_2HUB*	−.042	.152**		
	(.028)	(.058)		
*post*ACTUAL_0HUB*	.046**	−.105**	.046**	−.105**
	(.010)	(.018)	(.010)	(.018)
*post*ACTUAL_US*			.079**	.040
			(.015)	(.031)
*post*ACTUAL_AA*			−.025*	−.057*
			(.013)	(.025)
post	.168**	.196**	.159**	.195**
	(.015)	(.028)	(.015)	(.028)
*post*POTENTIAL*	.042**	−.064**	.042**	−.064**
	(.010)	(.018)	(010)	(.018)
*post*NONE*	−.001	.140	−.004	.139
	(.080)	(.156)	(.080)	(.156)
ln(*HHI*)	.023*	.081**	.020*	.079**
	(.010)	(.023)	(.010)	(.023)
hub	.002**	.001^{+}	.002**	.001^{+}
	(.0003)	(.0006)	(.0003)	(.0006)
ln(*pop*)	−.068	−.199	−.090	−.211
	(.099)	(.177)	(.099)	(.177)
ln(*income*)	−.550	−1.45*	−.296	−1.42*
	(.350)	(.646)	(.351)	(.649)
constant	11.43**	21.83**	9.03*	21.66**
	(3.97)	(7.29)	(3.98)	(7.32)
$\bar{R}^2$	.42	.82	.42	.82

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That is, a market associated with a US hub that AA competes in can potentially differ from an AA hub that US competes in since they may not necessarily offer the same level of service at each other's hubs. The variable *ACTUAL_US* indicates markets in which US is the hub owner that AA competes in and *ACTUAL_AA* indicates AA hubs that US competes in.

The last two columns of table 4 report the results. Notice the estimates on the variable *post*ACTUAL_0HUB* are the same as before because they are non-hub markets. In US hub markets that AA competes in, prices increase about 8.2 percent with output unchanged; but in AA hub markets that US competes in, output decreases 5.5 percent with price slightly decreasing (2.5 percent). The differences in the price and output effects between US and AA hub markets suggest that AA was an important pricing constraint on US hub markets but that the greater output constraint came from US's presence in AA hub markets.

In sum, hub markets and ownership are important in affecting merger outcomes. Specifically, when both market endpoints are hubs of the merging airlines, the merger is not necessarily anticompetitive, because it can lead to greater traffic between those hubs. The price and output effects of a merger can differ because the extent to which the airlines exert competitive pressure on each other before the merger depends on whether the hub is US or AA.

3.3 Potential-Competitor Identity and Endpoint Presence

We investigate two variations relating to the effects of potential competition: (i) the identity of the potential competitor and (ii) whether it has presence at one or both endpoints of the market. Potential competition so far has been defined as having presence at one or both endpoints of the market, but no distinction has been made regarding the identity of the potential competitor. Knowing the identity of the potential competitor can provide evidence on who exerts more competitive pressure. The variable *POTENTIAL_US* indicates markets in which US is the potential competitor of AA. These markets are served by AA, but US has presence at one or both endpoints. Similarly, *POTENTIAL_AA* indicates AA is the potential competitor in US markets.

The first two columns of table 5 report the results. In AA markets in which US is the potential competitor, price increases 4.6 percent and output decreases 11.94 percent. In US markets in which AA is the potential competitor, price increases 3.9 percent but output is unchanged. The output estimates are statistically different, but price estimates are not. These results indicate that while both airlines exert similar pricing constraint on each other, US (vis-à-vis AA) exerts the stronger output effect.

The second variation is on whether the potential competitor has presence at one or both endpoints of the market. The variable *POTENTIAL_ONE* indicates either AA's or US's presence at one endpoint and *POTENTIAL_TWO* indicates presence at both endpoints. The results indicate that prices increase 5.3 percent and output decreases 10.6 percent in the case of having presence at one endpoint. The price and output effects are slightly lower in the case of two endpoints: 4 percent increase and 5.2 percent decrease. The output estimates are statistically different, but the price estimates are not, suggesting that the output effect is stronger when the potential competitor has presence at one endpoint but the price effect is the same regardless of endpoint presence. Since much of the adverse effect on output comes from US as the potential competitor, suggesting that US exerts the stronger competitive constraint on AA than vice versa.

In sum, these two variations suggest that the identity of the potential competitor matters more than whether it has presence at one or both endpoints of the market. Particularly, when the potential competitor is US, the decline in output is greater than when the potential competitor is AA, and US does not need to have presence at both market endpoints to have this stronger effect. These results suggest that eliminating potential competition may be more harmful than eliminating actual competition because the number of markets affected is larger and the adverse effects on price and output are more persistent.

Table 5: Identity and Endpoint Presence

Variable	US vs AA		ONE vs TWO	
	$\ln(p)$	$\ln(q)$	$\ln(p)$	$\ln(q)$
*post*POTENTIAL_US*	.046**	−.126**		
	(.012)	(.021)		
*post*POTENTIAL_AA*	.039**	−.016		
	(.011)	(.020)		
*post*POTENTIAL_ONE*			.052**	−.112*
			(.014)	(.025)
*post*POTENTIAL_TWO*			.039**	−.053**
			(.010)	(.019)
post	.161**	.202**	.161**	.208**
	(.015)	(.028)	(.015)	(.028)
*post*ACTUAL*	.032**	−.084**	.032**	−.083**
	(.009)	(.017)	(.009)	(.017)
*post*NONE*	−.002	.151	−.00001	.135
	(.080)	(.158)	(.080)	(.155)
ln(*HHI*)	.027*	.075**	.027*	.076**
	(.010)	(.023)	(.010)	(.023)
hub	.002**	$.001^{+}$	.002**	$.001^{+}$
	(.0002)	(.0006)	(.0003)	(.0006)
ln(*pop*)	−.064	−.092	−.043	−.279
	(.100)	(.181)	(.100)	(.178)
ln(*income*)	−.351	−1.68**	−.358	−1.77**
	(.347)	(.642)	(.349)	(.643)
constant	9.23**	22.88**	9.02*	26.27**
	(3.94)	(7.28)	(3.93)	(7.25)
$\bar{R}^2$	.42	.82	.42	.82

3.4 Nonstop Versus Connecting Routes

Since market competition in routes that require a layover can differ from those that do not, this section makes a distinction between nonstop and connecting routes. Columns 1A and 1B in Table 6 reports the baseline results for nonstop and connecting routes along with two variations that were discussed earlier. To save space, only the estimates of interest are reported from the various regressions. We discuss these results first, and then turn to several sensitivity checks in the next section.

For nonstop routes, the estimates on *post*ACTUAL* indicate that overall price decreases about 5 percent (t=3.11) and output increases 5.9 percent (t=1.57), but the latter result is not statistically significant. If we disaggregate this variable into various hub markets, price decreases the most in two-hub markets with 12.5 percent; prices decrease 5.8 percent in one-hub and 3.3 percent in non-hub markets. The effects on output are not statistically significant for one- and non-hub markets, but increase substantially (by more than 50 percent) in two-hub markets. These results provide clearer evidence that most of the procompetitive effects are from nonstop routes in markets in which both endpoints are hubs of the merging airlines. The adverse effects are from connecting routes with an overall price increase of 5.7 percent (t=5.09) and output decrease of 11.2 percent (t=6.21). Non-hub and one-hub markets are the most affected, with prices 6.5 and 4.2 percent higher and output 12.3 and 9.6 percent lower. The effects in two-hub markets are not statistically significant.

In the case of potential competition, output decreases for both connecting and nonstop routes, with the latter having the larger decrease (5.2 percent vs. 9.3 percent). Much of these reductions (17.6 percent nonstop and 11 percent connecting) comes from markets in which US is the potential competitor rather than AA. Price effects are not statistically significant for nonstop routes, but prices are higher by 4.8 percent for connecting routes. In this case, the price increases are similar when either US or AA is the potential competitor, with increases of 5.4 and 4.4 percent.

In sum, the foregoing analysis makes clear that in nonstop two-hub markets in which the merging airlines previously competed, the effects have been procompetitive. Connecting routes in one- and non-hub markets are where most of the adverse effects are coming from. The elimination of potential competition raises price and reduces output for nonstop and connecting routes, particularly those in which US was the potential competitor.

3.5 Sensitivity Analysis

Although the premerger price and output trends of the control routes are similar to the affected routes, the average number of passengers on a route is lower, and the average route distance is also shorter relative to the affected routes. To check for the robustness of the baseline results, the control routes are filtered such that their route passengers and distances are similar.

Table 6: Nonstop vs. Connecting Routes & Sensitivity Checks

	NONSTOP ROUTES					
	1A: Baseline		2A: Passenger		3A: Distance	
Variable	$\ln(p)$	$\ln(q)$	$\ln(p)$	$\ln(q)$	$\ln(p)$	$\ln(q)$
*post*ACTUAL*	−.050**	.057	−.062**	.079*	−.058**	.064^{+}
	(.016)	(.036)	(.017)	(.034)	(.018)	(.034)
*post*ACTUAL_1HUB*	−.060**	.056	−.073**	.079^{+}	−.069**	.065
	(.019)	(.045)	(.020)	(.043)	(.020)	(.043)
*post*ACTUAL_2HUB*	−.127**	.420**	−.140**	.446**	−.137**	.432**
	(.043)	(.118)	(.043)	(.117)	(.043)	(.117)
*post*ACTUAL_0HUB*	−.034^{+}	.019	−.045*	.039	−.040*	.024
	(.018)	(.042)	(.019)	(.039)	(.019)	(.040)
*post*POTENTIAL*	.028	−.098**	.015	−.074*	.019	−.088*
	(.018)	(.037)	(.019)	(.036)	(.020)	(.036)
*post*POTENTIAL_US*	.022	−.193**	.010	−.172**	.014	−.187**
	(.024)	(.048)	(.025)	(.047)	(.025)	(.047)
*post*POTENTIAL_AA*	.032	−.044	.018	−.019	.021	−.033
	(.020)	(.044)	(.021)	(.042)	(.021)	(.042)

	CONNECTING ROUTES					
	1B: Baseline		2B: Passenger		3B: Distance	
Variable	$\ln(p)$	$\ln(q)$	$\ln(p)$	$\ln(q)$	$\ln(p)$	$\ln(q)$
*post*ACTUAL*	.055**	−.119**	.052**	−.100**	.055**	−.104**
	(.011)	(.019)	(.012)	(.020)	(.013)	(.021)
*post*ACTUAL_1HUB*	.041**	−.101**	.039*	−.083**	.042**	−.086**
	(.014)	(.024)	(.015)	(.025)	(.015)	(.025)
*post*ACTUAL_2HUB*	.00002	.021	−.003	.038	.0003	.035
	(.036)	(.062)	(.037)	(.062)	(.037)	(.062)
*post*ACTUAL_0HUB*	.063**	−.131**	.060**	−.113**	.063**	−.116**
	(.011)	(.020)	(.013)	(.021)	(.013)	(.021)
*post*POTENTIAL*	.047**	−.053**	.045**	−.034	.048**	−.037^{+}
	(.012)	(.020)	(.013)	(.021)	(.013)	(.022)
*post*POTENTIAL_US*	.053**	−.117**	.050**	−.099**	.053**	−.102**
	(.014)	(.023)	(.015)	(.024)	(.015)	(.025)
*post*POTENTIAL_AA*	.043**	.005	.040**	.024	.043**	.021
	(.013)	(.022)	(.014)	(.023)	(.015)	(.023)

For nonstop routes, the definition of similar passengers is that the number of passengers in the control must be at least 10 percent the average number of passengers in the affected. For connecting routes, it is at least 30 percent. Results of this filter are shown in columns 2A and 2B. Columns 3A and 3B add a distance filter, where the control distances for nonstop routes are at least 20 percent the average distance of affected and 30 percent for connecting routes. These filters have brought the control and affected closer in these dimensions but they have also made their market sizes and average prices closer as well. This approach is similar to the one taken by Carlton et al (2019).

Across all specifications, the direction and statistical significance of these price and output estimates are basically consistent with the baseline results. The magnitude of these estimates are however slightly different for actual and potential competition. Price and output estimates on the variable *post*ACTUAL* are slightly larger (in absolute value) for nonstop routes but somewhat smaller for connecting routes particularly on output. These results are consistent when disaggregated to various hub markets, suggesting that the procompetitive effect is actually stronger for nonstop routes but the adverse effect in connecting routes is smaller. For potential competition, the output estimates on the variable *post*POTENTIAL* are slightly smaller for both nonstop and connecting routes but the price effects are similar with the baseline results even when disaggregated to US versus AA as the potential competitor.

These sensitivity checks suggest the importance of using similar control routes to compare because the baseline has slightly underestimated the impact in actual markets but overestimated in potential markets.

4. Conclusions

This paper evaluates the price and output effects of the US/AA merger in markets in which the airlines previously competed directly and indirectly. We found that the merger decreases price and significantly increases output in competing markets associated with their hubs, but it is quite harmful in markets in which they indirectly competed, particularly when that competitor is US. While these results are specific to this merger, they suggest that any postmerger analysis should consider how output is affected in addition to price, make a distinction between competing hub and non-hub markets, and consider the loss of potential competition, particularly when a large number of these markets are affected.

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