

Dynamic Non-Price Effects of Multimarket Contact: Evidence from an Airline Merger

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Abstract

This paper examines non-price effects of multimarket contact (MMC). We take advantage of a recent merger, which altered extent of MMC throughout the US airline industry to understand the nature of MMC's impact on frequency and aircraft size, the two crucial non-price characteristics of airlines' product. There is little robust evidence that non-price effects of MMC are a part of the longer term industry equilibrium. However, we observe that following the merger market players started taking degree of MMC into account in making their frequency and aircraft size decisions in line with hypotheses we suggested; the magnitude of the effect was diminishing over time. Our results may have implications for merger evaluation in industries where consolidation may lead to higher extent of MMC.

Keywords: Multimarket contact; mergers; product quality; airline industry

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1. Introduction

Multimarket contact (MMC) occupies a well deserved place in the list of factors allegedly facilitating tacit collusion on imperfectly competitive markets. The idea of “mutual forbearance”, whereby a firm may be inclined not to break tacit collusion agreement on a given market for fear of retaliation on other markets where it competes with the same firms, has been around for decades; yet it remained outside of the realm of theories of imperfectly competitive markets until Bernheim and Whinston’s (1990) study.

Following Bernheim and Whinston, a series of studies examined price effects of multimarket contact in various industries². It is however obvious that tacit collusion may entail coordination of not only pricing policies, but also other product characteristics. For example, higher profit margins may be supported by either withdrawing supply leading to lower quantity as compared to the non-collusive equilibrium; or lowering cost by decreasing product quality below that implied by the industry equilibrium. The possibility that multimarket contact may facilitate collusion via lower product quality has not been given adequate consideration in the literature. The only study that looks at correspondence between multimarket contact and non-price product characteristics is by Prince and Simon (2008). Learning whether observed price effects of MMC are compounded from the supply and product quality side will allow us to better understand the effects of market power associated with multimarket contact.

This paper takes advantage of an event which increased multimarket contact throughout the entire US airline industry to examine the effect of “mutual forbearance” on non-price product dimensions both cross-sectionally and dynamically. Specifically, in September of 2005 a merger was approved between two major carriers: America West Airlines and US Airways (technically, America West bought US Airways, keeping the airline’s name). The combined market share of origin-and-destination passengers carried by the two airlines in 2005 was almost 11 percent³. In terms of the involved airlines’ networks, the merger was more complementary than parallel, with America West’s main operations in the Western and Southwestern states, and US Airways’ predominant

² See Piloff (1999), Busse (2000), Jans and Rosenbaum (1995), Evans and Kessides (1994), Fernandez and Marin (1998), Focarelli and Panetta (2003), Singal (1996).

³ As reported by Darin Lee on <http://www.darinlee.net/data/shares.html>

presence on the East Coast; in fact, the two carriers competed directly with non-stop services on only half a dozen routes.

Anti-competitive effect of multimarket contact on total capacity can be manifested via lower frequency of service, larger aircraft size or both. Once effect of MMC on both frequency and aircraft size is estimated; the total capacity effect can be calculated (as total capacity is just frequency times the average aircraft size). Reducing total capacity in response to higher extent of multimarket contact amounts to supply withdrawal and exercise of market power. Reduction in frequency of service following more extensive MMC, on the other hand, will constitute MMC – product quality relationship, consistent with the “mutual forbearance” hypothesis.

It is mentioned above that our research design allows evaluating effects of multimarket contact both cross-sectionally and dynamically. Specifically, in addition to evaluating the effect of MMC for our entire sample, we can suppose that the merger could have provided the market players with an incentive to attempt setting a different collusive agreement as compared to the pre-merger one. In essence, we suppose that (and test whether) the merger leading to both higher industry concentration and higher degree of multimarket contact could have triggered a change in the way MMC is taken into account by market players in choosing aircraft size, frequency of service, and ultimately total offered capacity.

For our analysis, we use data on non-stop flight frequencies and passenger traffic volumes throughout the US airline industry; we use the data for 2003, 2004 (two years before the merger), as well as 2006 and 2007 (two years after the merger was approved). We employ difference-in-differences identification strategy to account for general trends in the industry over the said time period; carrier and market specific heterogeneities are accounted for with the help of market and airline-market fixed effects models. Several measures of multimarket contact are employed.

Looking at the entire sample and not assuming any structural effect of the merger on the alleged tacitly collusive agreement, we fail to detect robust evidence of the impact of MMC on frequency and aircraft size. Only one of the MMC measures shows stable expected effect on frequency; yet, there are notable differences between results for pre-merger and post-merger sub-samples.

Testing our contention that the merger had a structural across-the-industry effect on the way MMC is taken into account by market players; we concluded that association between MMC and frequency as well as between MMC and aircraft size changed following the consolidation. This effect is most pronounced in airline-market fixed effects specifications and using airline-market specific (rather than popular in the literature market-specific) measures of MMC; and is stronger one year after the merger than further down the road. The results are robust to excluding merger participant from the sample and artificial imposition of post-merger time period. Depending on the measure of MMC used, the size of the effect implies either lower or unchanged total offered capacity.

Overall, our results are consistent with the following story. After the event which increased both industry concentration and the extent of multimarket contact, the airlines across the industry attempted a new tacit collusion agreement, whereby carriers started paying more attention to the extent of MMC on a given market in determining frequency and average aircraft size. Looking at the longer term, however, it appears that success of this new collusive agreement was limited.

As we mentioned above, price effects of multimarket contact have been examined for a number of industries. Analysis for the airline industry has been offered by Evans and Kessides (1994) and Singal (1996). The only available analysis of impact of MMC on non-price product characteristics (Prince and Simon, 2008) also looks at the airline industry, examining predominantly the impact on flight delays and cancellations, and discovering the presumed effect. Prince and Simon also analyze impact of MMC on frequency, failing to find any significant effect.

In addition to papers mentioned in the previous paragraph, the following empirical studies of airline industry have relevance to our research. Pai (2008) offers a general examination of determinants of aircraft size and frequency choices in the US airline industry. Bilotkach, Fageda, and Flores-Fillol (2008), focusing primarily on relationship between frequency choice and length of haul, offers an analysis of frequency choice by airlines on a set of European markets. Richard (2003) examines welfare effects of a hypothetical merger between American Airlines and United Airlines for Chicago-originating routes, focusing on the carriers' choice of prices and frequency. Borenstein

(1990) and Kim and Singal (1993) examine price and market power effects of the 1980s wave of airline mergers.

We can learn the following from our analysis. First, MMC can influence firm's choices of non-price product characteristics. Second, rather than being a part of equilibrium industry structure, this impact may be precipitated by an exogenous change in the level of MMC. Finally, we suggest that mergers that have significant industry-wide effect on the extent of MMC may produce industry-wide strategic shifts in choice of non-price product characteristics, extending beyond markets on which merger participants directly compete.

The paper is organized in the following straightforward way. Next section provides background information on the US Airways–America West merger; Section 3 describes preparation of the data for analysis. Section 4 discusses data analysis methodology and results. Section 5 concludes.

2. US Airways – America West Merger

The US airline industry has seen a lot of turbulence since the market was deregulated in 1978. In the first years after the Airline Deregulation Act, scores of new players entered the industry. This was followed by the wave of mergers in the 1980s, which led some to fear consolidation would bring less competition and even higher fares than before deregulation. Throughout the 1990s (especially in the second half of the decade) the industry has been in a relatively good shape, taking advantage of robust economic growth and low fuel prices.

The events of September 11, 2001 shook the airline markets violently, with all carriers but Southwest Airlines ending the year in the red. In addition, jet fuel prices started rising shortly afterwards. Since then, several major carriers (US Airways, United Airlines, Delta Air Lines, Northwest Airlines) spent some time under Chapter 11 bankruptcy protection,⁴ and American Airlines was close to having to resort to this arrangement. The industry saw entry by JetBlue Airways (2000); Virgin America (2007), and short-lived operation by SkyBus. At the same time, TWA left the market in 2001 merging with American Airlines; Independence Air, Aloha Airlines and ATA seized to

⁴ Arrangement that grants the firm protection from creditors while it undergoes restructuring.

exist, as did America West Airlines, effect of merger of which with US Airways is analyzed in this study. Northwest Airlines is also about to disappear, following the merger with Delta Air Lines.

USAir (later changed to US Airways) is the name pre-deregulation Allegheny Airlines adopted after expanding substantially throughout the 1980s, acquiring Pacific Southwest Airlines and Piedmont Airlines in 1987 (purchase of the latter company was then the largest merger in the airline industry). The carrier has grown throughout the 1990s, developing hubs in Baltimore, Philadelphia, Charlotte, and Pittsburgh, as well as establishing itself as the biggest airline at Regan National Airport in Washington, D.C. (airport code DCA). In general, while the airline operated a nationwide network (along with some transatlantic and transpacific flights), US Airways' presence was much more pronounced on the East Coast than on the West. Presence in DCA meant that US Airways was disproportionately hit by the events of September 11, 2001; due in part to its proximity to Washington D.C., the airport remained closed for several weeks after the attack, and the carrier suffered a significant financial blow. The airline has, however, held on until August 11, 2002 before entering Chapter 11 bankruptcy protection⁵. US Airways was able to emerge from Chapter 11 in 2003, only to be forced there again on September 12, 2004 by rising fuel prices and deadlocked negotiations with unionized labor. At that time, the airline's share of domestic passengers was about seven percent, down from over ten percent before September 11, 2001.

America West Airlines was one of the carriers that emerged after deregulation. In fact, some researchers considered America West a low-cost carrier (the airline, by effectively sharing a hub with Southwest Airlines, had to compete with this US low-cost leader on a number of routes, which meant it had strong incentives to be cost-efficient). The airline started flying on August 1, 1983, out of hubs in Phoenix and Las Vegas. As location of the carrier's hub airports suggests, America West concentrated its operations in Western (more specifically, Southwestern) part of the country (in 1990s the airline established a smaller hub in Columbus, Ohio, which was dismantled in 2003); it did operate coast-to-coast services, as well as flights to Mexico, Canada, and Hawaii. While

⁵ According to the US Bankruptcy Code, a business can file for bankruptcy protection under either Chapter 7 (implying cessation of operation) or Chapter 11 (implying reorganization to ultimately stay in business).

an important player in the Southwestern part of the US airline market, America West remained a relatively small airline; its market share never exceeded four percent in terms of the number of passengers carried (this was America West Airlines' share just before the merger examined in this paper).

The two carriers, while operating non-overlapping networks, were no strangers to each other: in fact, they were part of the code-sharing agreement, which also included United Airlines. Soon after US Airways went into Chapter 11 proceedings for the second time in as many years, America West suggested buying the carrier, keeping US Airways name⁶. The merger (the transaction is widely referred to as the merger, even though it looked more like an acquisition) did not meet much resistance from the regulators, due to non-overlapping nature of the parties' networks. In fact, the two airlines directly competed only on half a dozen routes with non-stop flights. The merger was closed on September 27, 2005, but negotiations with the labor unions and merging the airlines' reservation systems was put off to a later date⁷. The America West operating certificate was only merged into that of US Airways (meaning America West Airlines "officially" ceased to exist) only two years after the merger was closed; nevertheless, the carriers' decision-making (as far as price setting and scheduling is concerned) has been joint since the merger closing date. From September 27, 2005 until merger of the operating certificates all America West flights have been flown as "US Airways flights operated by America West Airlines".

The America West – US Airways merger provides a rather "clean" event for examining the dynamic effects of MMC, for the following reasons. First, unlike the wave of mergers in the 1980s, this was a stand-alone event. Second, the merger had repercussions for the entire airline industry, as networks of the merger participants were complementary and covered most of the US market. Third, the merger effectively turned one mid-size and one smaller carrier into then fourth largest airline on the US market, in terms of the number of domestic origin-and-destination passengers carried⁸. Fourth, unlike the other merger in the new millennium (American Airlines' acquisition of TWA

⁶ This is similar to 1982 purchase of Continental Airlines by Texas Air Corporation.

⁷ As an example, US Airways' pilots and flight attendants had on average been with the airline for longer time than America West's workers (since US Airways is an older airline). So, merging the carriers' seniority lists proved a rather complicated matter.

⁸ US Airways is currently fifth largest US carrier by this measure.

in April 2001), no catastrophic events occurred in the US airline industry around the time of the merger examined in this paper; the airlines' response to rising fuel prices can be taken into account easily within the difference-in-differences framework.

3. Data

3.1 Sample

The main dataset we will use in our analysis is T100 segment, collected monthly by the US Department of Transportation and available from the Department's web-site. The dataset includes, at the airline-airport-pair-market level, information on the number of seats offered, passengers carried, and flights performed by each airline on each market where the carrier offers non-stop passenger service.

We confined our analysis to two years before the US Airways – America West merger (2003 and 2004) and two years after the event (2006 and 2007). Further, we only used information for February and July of each year. Traditionally, February is the month where demand for air travel is at its trough, while in July it is at its peak. Also, airlines tend to set schedules semi-annually (so-called Winter and Summer schedules); so choosing only two months of the year we will not lose much information as far as airlines' choice of frequency and aircraft size is concerned.

We included into our sample only routes within contiguous United States (thereby excluding flights to/from/within Alaska and Hawaii, as well as flights to/from Puerto Rico); we also required that a route had to be served with scheduled commercial passenger airline flights at least twenty times a month in February and twenty one times in July (this is roundtrip frequency, so we effectively included all routes on which about one flight per three days was scheduled). Data for regional carriers providing services for network airlines were merged with that for the corresponding network carriers⁹. For eight months we included into our dataset, we ended up with over 16,000 unique airline-airport-pair-market level observations, representing 1,926 unique airport-pair markets

⁹ On the US market, some of the commercial passenger services (particularly on thinner markets) are performed by so-called regional carriers, effectively operating as agents of major airlines. Those can be either independent companies (SkyWest, Atlantic Southeast); or fully owned subsidiaries of major carriers (American Eagle). Several such airlines perform services for more than one major airline (e.g., SkyWest flies as Delta, United, and Midwest agent). Where a regional carrier was known to perform flights for more than one major airline, classification was made according to the hub airport to/from which the service was performed; airlines sharing hub airports have not been found to share a regional carrier.

with non-stop services. Of those, 623 airport-pair markets featured non-stop services by more than one carrier in at least one of the months covered by our data.

3.2 Variables

As dependent variables, we use natural logarithm of monthly frequency¹⁰, and natural logarithm of average aircraft size, at the airline-route level. Average aircraft size is obtained by dividing the number of seats offered by the number of departures performed.

The literature offers various measures of MMC, and there is no conventional way to compute this variable. Generally speaking, route-specific measures seem more popular. While we in this study will, among others, use average multimarket contact measure identical to the one used by Evans and Kessides (1994); our focus will be on airline-market specific measures. Let us go over an example which will hopefully convince you that using an airline-market specific measure is a more realistic way to go. Suppose we have a market on which three airlines (carriers 1, 2 and 3) operate. Further, suppose airline 1 faces competitors 2 and 3 on a total of 100 routes; carrier 2 also competes with the two other airlines on 100 markets; whereas carrier 3 only meets carriers 1 and 2 on 10 routes. Averaged across the three carriers, route-level multimarket contact in this case will be 70. Use of this measure is equivalent to assuming that the three airlines will set their strategies in the similar fashion. This may not be realistic: if MMC is taken into account by the market players from our example, it will be more important for airlines 1 and 2 than for airline 3 from our example. Using airline-market specific measures should take care of this problem.

We will use two airline-market level measures of multimarket contact; one capturing the “absolute” extent of multimarket contact (this will be denoted *AMMC*), and the other revealing MMC “relative” to the airline’s total operations (we will use notation *RMMC* for this one).

The first measure will simply count the number of markets on which the airline competes with non-stop services with other carrier(s) it encounters on a given route. Specifically, for each pair of airlines (*i* and *j*), we count the number of airport-pair

¹⁰ Frequency is adjusted by the number of days in the month: February frequency is multiplied by 31/28 (31/29 for 2004, which is leap year).

markets on which the two carriers both provide non-stop service (denote this number via n_{ij}). Then, extent of MMC for airline i on market k will be calculated as:

$$AMMC_i^k = \sum_{j \neq i} I_{ij}^k n_{ij} \quad (1)$$

Where I_{ij}^k is simply the indicator of whether the two airlines both offer non-stop services on the given airport-pair market; and the summation is done over the set of airlines in the population.

To calculate the second measure of airline-market level MMC, we will calculate the total number of flights carrier i performs on the markets on which it faces competition with airline j with non-stop services (we will denote this number via f_{ij}). Specifically:

$$f_{ij} = \sum_k I_{ij}^k f_i^k \quad (2)$$

Summation in (2) is done over all airport-pair markets. Then, if the total number of flights that an airline i performs over its entire network is F_i ; the “relative” measure of MMC for airline i on market k will be:

$$RMMC_i^k = \frac{1}{F_i} \sum_{j \neq i} I_{ij}^k f_{ij} \quad (3)$$

Note that both measures of multimarket contact will be equal to zero for all monopoly airport-pair markets.

Last but not least, the market-specific measure of multimarket conduct we will use in some specifications (it is also one of the measures used by Evans and Kessides (1994), as indicated above) will be simple average of the above-described measures of “absolute” multimarket contact for a given market, or:

$$AvgMMC^k = (N^k)^{-1} * \sum_i I_i^k * AMMC_i^k \quad (4)$$

Where N^k is simply the number of unique carriers operating on the market k , and I_i^k is the indicator of airline i 's presence on the market. Also note that, mathematically, mean $AvgMMC$ will be the same as the mean $AMMC$.

Table 1 includes descriptive statistics for dependent variables and measures of MMC we use. It is evident that the US Airways – America West merger did result in increase in average MMC throughout the industry; also visible are general trends for

lower frequency of service and lower average aircraft size over time (these general trends are clearly stipulated by increasing price of jet fuel, which went up 150 percent from 2003 to 2007, rising at a much faster rate before the merger than after the event¹¹). Note that frequency trend is more pronounced on non-monopoly routes; whereas size trend is more visible on monopoly markets.

Our estimation techniques of choice will be airport-pair-market and airline-airport-pair-market fixed effects¹². To account for market heterogeneities not captured by the fixed effects, we will use geometric averages of endpoints' per capita income and population, as well as route Herfindhal index as independent variables. Time (month-year, month and year) dummies will be used in all specifications to account for corresponding heterogeneities. In airport-pair-market fixed effects specifications, we will also use airline dummy variables.

4. Analysis and Results

4.1 Hypotheses and Methodology

Generally, anti-competitive non-price effects of MMC can be manifested through the measure's association with lower offered capacity and/or lower product quality (which is represented in our dataset via service frequency, generally considered directly related to convenience of airline's service to passengers).

Our aim is to examine how MMC is taken into account by market players in determining frequency and aircraft size (effect on capacity will be calculated accordingly, taken into account that capacity is nothing but the product of the two). We can perform the analysis both without separating effects of the merger, effectively considering MMC as part of the longer-term industry equilibrium; as well as postulating that the US Airways–America West merger (having increased both industry concentration and the extent of MMC) could have had a structural effect on the way MMC affects airlines' choice of frequency and aircraft size.

¹¹ According to Energy Information Administration data, jet fuel price went up 38 percent in 2004 relative to 2003, and another 43 percent in 2005 relative to 2004; in 2006, jet fuel price registered 14 percent year-over-year increase; and went up another 10 percent in 2007.

¹² This means, among other things, that distance will be absorbed by fixed effects.

Making such a distinction allows us to make conclusions on the origins of the effect of multimarket contact. If we determine that the merger was the primary force behind any observed non-price effects of MMC, we will be able to claim that changes in the industry structure can have a “structural” impact on market players’ strategies. Any estimated effect of MMC in analysis assuming merger had not impact will give us a general indication of the effect this variable has on airlines’ non-price competition strategies in what could be considered a longer-term industry equilibrium.

To sum it up, expected association between MMC and our variables of interest is as follows. *We expect higher extent of MMC to be associated with lower frequency of service and choice of larger aircraft.*

If this association is part of longer-term industry equilibrium, we will observe it through corresponding signs of the coefficients on measures of MMC. Study of the effect of the merger on MMC-frequency and MMC-aircraft size relationships will require difference-in-differences identification strategy. Here we will approach the problem in two ways. First, since increase in MMC following the merger should not have changed airlines’ choices on the monopoly markets beyond the general industry trend: any post-merger versus pre-merger difference in frequency and size choices on non-monopoly markets should be more significant than same for the monopoly routes, if our contention is true. The corresponding regression specification will be:

$$Y = \beta_1 I_{post-merger} + \beta_2 I_{non-monopoly} + \beta_3 I_{post-merger} * I_{non-monopoly} + controls + error \quad (5)$$

Then, the key variable will be the post-merger-non-monopoly-route indicator variable, and if our hypothesis of structural impact of the merger on relationship between MMC and non-price characteristics is true, the corresponding coefficient (β_3) will be negative if frequency is used as the dependent variable, and positive if aircraft size is the dependent variable.

This approach, however, does not take advantage of our measures of MMC; also, any changes in airlines’ competition strategies not associated with the change in MMC and resulting in lower frequency or choice of larger aircraft will yield observationally equivalent results. Therefore, the second approach will utilize our measures of multimarket contact, at the expense of excluding monopoly airport-pair markets from the sample. Specifically, we will estimate the following regression:

$$Y = \gamma_1 I_{post-merger} + \gamma_2 * MMC + \gamma_3 I_{post-merger} * MMC + controls + error \quad (6)$$

Where *MMC* is one of our measures of multimarket contact. The main variable is again interaction between post-merger indicator and the measure of multimarket contact, and, as before, if our hypothesis is true, the corresponding coefficient (γ_3 this time) will be negative if frequency is used as the dependent variable; and positive if aircraft size is the dependent variable.

In either case, we will estimate two models: market level fixed effects, and airline-market level fixed effects. The latter should give a better picture, as it will enable taking a better account of the fact that most carriers on the US airline market operate hub-and-spoke networks, so that frequency and aircraft size decisions are made taking into account demand not only on spoke-to-hub markets, but also on spoke-to-spoke routes.

Additionally, we will administer a simple robustness check to make sure any effect we might observe is associated with the merger and is not just a trend that has not been picked up by the controls we have used. Specifically, we will run our specifications for the “before the merger” and “after the merger” sub-samples, artificially imposing treatment where it has not taken place; details are in the next sub-section.

4.2 Results

Evidence that effect of MMC on frequency, aircraft size and ultimately capacity is part of longer-term industry equilibrium does not appear robust. We can see that from Table 2, which reports effects of each of three measures of MMC without giving any special treatment to the merger (that is, omitting post-merger indicator variable, as well as post-merger–MMC interaction from the specification), both for the entire sample, as well as for the pre-merger and post-merger sub-samples. We can see that expected effect on frequency is observed in many specifications (implying lower offered capacity, given lack of effect on aircraft size). However, there are clear differences across the two airline-route specific measures of MMC. Also, discrepancies between results for pre-merger and post-merger sub-samples clearly indicate that the merger might have changed the way airlines consider MMC in making frequency and aircraft choice decisions.

Results of estimation, related to the contention that the merger had a structural across-the-industry effect on the way MMC is taken into account by market players, are presented in the following tables. Table 3 presents outcome of estimation of specification

(5); Tables 4 and 5 depict estimation results for specification (6) for the three measures of MMC we used (results for AMMC are presented in a more expanded way as compared to the two other measures); Tables 6 and 7 replicate Tables 2 and 3 with merger participants excluded from the sample. Table 8 reports coefficients on MMC*Post-Merger interaction variable for the sub-sample including years 2003 and 2007 (i.e., two years before and two years after the merger) – these can be called estimates of the “longer term” effect of the merger on the impact of MMC on non-price product characteristics.

Finally, Table 9 provides results of a “robustness check”, aimed at ascertaining that effects reported in the preceding tables can be attributed to the US Airways–America West merger rather than to the general industry trends. For this, we separately consider pre-merger (2003 and 2004) and post-merger (2006 and 2007) sub-samples, estimating specifications (5) and (6) artificially assigning “post-merger period” to the later of the two years (2004 and 2007, respectively).

We can learn the following from the above mentioned tables. First, it is clear that following the merger frequency on non-monopolistic markets decreased more significantly than on monopolistic routes (the size of this effect is also non-trivial, about 7-8 percent). No comparable effect for the aircraft size is observed, however. These two facts imply that the merger – having led to more extensive MMC across the board – changed the way multimarket contact enters airlines’ strategies, leading to decreased capacity via lower frequency.

A more detailed examination (studying only non-monopolistic routes and employing three measures of MMC as identified above) revealed the expected effect for the two airline-market specific measures of MMC. The effects are more pronounced in airline-market fixed effect models. No robust evidence for post-merger impact of MMC on airlines’ strategies pertaining to choice of frequency, aircraft size and capacity was detected in specifications using the market-specific MMC measure (AvgMMC). Results are robust to excluding merger participants from the sample. Finally, robustness check reported in Table 9 confirms that the effects we observed can be considered associated with the US Airways–America West merger rather than representing an abnormality in the general industry trend.

Reported estimation results with AMMC as the measure of multimarket contact (Table 4) allow distinguishing between “immediate” (sub-sample for one year before and one year after the merger) and “longer term” (entire sample, including two years before and two years after the merger) impacts of the merger on the way MMC is taken into account by market players when making decisions on non-price product characteristics. We can see from those estimates that the magnitude of the “immediate” effect is about twice that of the “longer term” effect (results for RMMC are structurally similar). In plain words this implies that following the merger (which increased extent of multimarket contact across the board) carriers took the new extent of MMC into account to adjust their frequency and aircraft size choices; however, some readjustment to pre-merger levels happened over time. We can learn more on this readjustment from results presented in Table 8. That table reports coefficients on MMC*post-merger interaction variable for the sub-sample including only years 2003 (two years before the merger) and 2007 (two years after the merger). One can immediately observe that the previously reported evidence of the merger’s effect on MMC–frequency and MMC–aircraft size association is weakened to the extent that it only shows up for one of the three measures of multimarket contact (and statistical significance of the relevant coefficients is not as strong). In general, these results appear consistent with carriers attempting a tacit collusion agreement following an event which increased extent of MMC throughout the industry; yet we can also say that this attempt was not especially successful – at least evidence for the longer-term “strategic” shift following the merger is not very robust.

Thus, looking at specifications using airline-market specific measures of MMC, we observe expected merger’s impact on both MMC-frequency and MMC-aircraft size relationships. Let us see what we can say about the magnitude of the estimated effects. Take an airline offering 7.5 – roughly the sample average – daily roundtrip services, with the average aircraft size at 100 seats (roughly pre-merger average); further assume that our hypothetical airline’s measures of multimarket contact on a given route are 70 for AMMC and 0.22 for RMMC (again, values close to sample averages). Take results reported in Table 4 and Table 7. More specifically, focus on results for airline-market fixed effects model, including all time periods in the sample.

Then, our results using AMMC measure will imply that following the US Airways – America West merger our hypothetical airline will add 1.4 seats and eliminate 0.3 daily (9 monthly) flights on routes where it competes with other carriers; this will correspond to about 2.6 percent drop in offered capacity, *in addition to the observed industry trend*. Using RMMC measure, our estimation results will produce 3.3 additional seats per aircraft and about 0.25 fewer daily (7.4 monthly) flights; corresponding to insignificant (less than one tenth of one percent) estimated drop in total capacity. Thus, AMMC measure will suggest a post-merger drop in offered capacity due to multimarket contact; whereas RMMC measure implies that (for our example) effect of more extensive MMC following the merger will be to fly bigger aircraft less often without any drop in capacity. These results are qualitatively different; the former implies withdrawal of supply as a result of higher extent of MMC, whereas the latter suggests simply lower product quality.

Thus, we first found (in specifications not giving any special treatment to the merger) some evidence that carriers might respond to more extensive multimarket contact by slashing frequency; however, no effect of MMC on the aircraft size choice was observed, and the estimates were unstable across measures of MMC and sub-samples. We then postulated that the US Airways–America West merger could have produced a change in MMC, significant enough for the multimarket contact to start affecting airlines’ frequency and aircraft size choices. We determined this to be true, especially for the airline-market fixed effects specifications, for airline-market specific measures of MMC; evidence for route-specific measures of multimarket contact is weaker. It is not entirely clear how this change in the way MMC enters airlines’ strategy affected carriers’ choice of capacity – the effect is either consistent with supply withdrawal (more extensive MMC led to lower overall capacity) or negligible. In either case, post-merger effect of MMC on non-price characteristics of airline services has been to lower the convenience of same, implying that well-documented anti-competitive price effects of MMC may be compounded by lower product quality, at least following an event that makes tacit collusion more likely.

It is also clear that the effect we observed is more significant immediately after the merger and dissipates later on (some evidence suggests complete dissipation); this

appears consistent with a not exceptionally successful attempt at enforcing a tacit collusion agreement on the non-price side of product characteristics following an event which probably would have made such a collusion more likely. Finally, robustness checks we implemented suggested the observed effect is due to the merger and cannot be considered random or explainable by general industry trends; it also holds when we drop merger participants from the sample.

The control variables show expected effect of market size measures on frequency (more flights on markets where there are more customers and where customers have deeper pockets); lack of statistical significance of the effect of population and per capita income on aircraft size is an artifact of airlines' network structure: aircraft size decisions are made based on the expected number of not only direct, but also connecting passengers. The effect of market concentration on frequency and aircraft size is as expected (an airline offers fewer flights and smaller planes on more concentrated markets, other things equal). Last but not least, with the airline-market fixed effects models we are able to explain a substantial share of variation in the dependent variables.

5. Concluding Comments

This paper takes advantage of a recent merger in the US airline industry to examine effects of multimarket contact on market players' behavior from a new angle. Specifically, we examine effects of MMC on non-price product characteristics (frequency of service and aircraft size), unlike most of the previous literature on the issue, which looks at the price effect of MMC. We thus would like to learn whether well-documented price effects are exacerbated on the product quality side, so that "mutual forbearance" leads to not only higher prices but also lower cost. Further, we are able to examine the impact of MMC both unconditionally on the merger and postulating that the merger, having changed the degree of multimarket contact throughout the industry, could have served as a kind of structural shock for the market participants, affecting the impact of multimarket contact on airlines' choice of frequency and aircraft size.

We do find that the US Airways – America West merger changed the way airlines throughout the industry take into account the degree of MMC when making strategic choices on frequency of service and aircraft size. Specifically, following the merger

higher degree of MMC became associated with lower frequency (above and beyond the general industry trend for fewer flights) and larger aircraft size (which is actually contrary to the corresponding industry trend for using smaller planes). Effect on total offered capacity is uncertain (either expected – more extensive MMC leads to lower overall capacity – or negligible, depending on the MMC measure employed). It is interesting that effects are more robust for specifications employing airline-market specific measures of MMC as compared to regressions using market specific measure (the latter approach appears more popular in the literature). Unconditional effect of MMC is only observed for frequency, and is unstable across both measures of MMC and specifications employed. Robustness check (incorrect imposition of post-merger period) revealed that the post-merger effect of MMC is clearly beyond the general industry trend.

It is also interesting to observe that (see Table 4) the obtained effects are larger in magnitude immediately after the merger than when evaluated over more extended time period. This pattern appears consistent with attempted tacit collusion following an event which would make such an outcome more feasible. This serves as an additional evidence of the “structural” shock that the merger had: it appears that in the longer term effect of MMC on variables of our interest is weak (as also evidenced by not robust unconditional effect on frequency), but an exogenous change in the extent of contact will affect market players’ conduct.

We can learn the following from our analysis. First, multimarket contact can influence firm’s choices of non-price product characteristics. Second, rather than being a part of equilibrium industry structure, this impact may be precipitated by an exogenous change in the level of MMC. Finally, we suggest that mergers that have significant industry-wide effect on the extent of MMC may produce industry-wide strategic (and not pro-competitive) shifts in choice of non-price product characteristics. The list of industries in which a merger can have a large-scale effect on the extent of multimarket contact is potentially long (hotels, fast food restaurants, banking, retail trade, just to name a few – generally, any industry where competition is between chains of stores); therefore it will be interesting to apply our methodology to other industries to gauge general applicability of our results. If similar evidence to that presented here is collected on other

markets; this may point to an additional effect to be taken into consideration when evaluating proposed mergers and acquisitions.

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Table 1 Descriptive Statistics

	Year	Multi-market contact		Average daily roundtrip frequency			Average aircraft size		
		AMMC	RMMC	All markets	Monopoly routes	Non-monopoly routes	All markets	Monopoly routes	Non-monopoly routes
Pre-merger	2003	56.75 (49.98)	0.217 (0.178)	7.74 (5.51)	6.96 (4.76)	8.90 (6.28)	101.16 (50.32)	98.76 (50.31)	104.70 (50.13)
	2004	58.72 (49.96)	0.231 (0.198)	7.77 (5.88)	7.02 (5.08)	8.79 (6.68)	99.62 (50.57)	97.18 (50.09)	102.93 (51.05)
Post-merger	2006	74.24 (55.13)	0.262 (0.191)	7.15 (5.44)	6.43 (4.70)	7.97 (6.19)	97.33 (50.02)	92.63 (50.91)	103.49 (48.15)
	2007	74.76 (54.31)	0.259 (0.190)	6.84 (5.33)	6.26 (4.67)	7.53 (5.97)	95.57 (50.09)	91.22 (51.34)	100.89 (48.01)

Notes:

1. Mean AvgMMC is the same as mean AMMC.
2. Not-weighted means are reported.
3. AMMC and RMMC averages computed for routes with two or more carriers offering non-stop flights.

Table 2 Effect of Multi-Market Contact Unconditionally on Merger

a) Entire sample

	Dependent Variable	AMMC	RMMC	AvgMMC
Market fixed effects	Frequency	-0.001** (2.5E-04)	0.342** (0.073)	-0.003** (4.8E-04)
	Size	-6.1E-04** (1.4E-04)	0.154** (0.052)	-5.1E-04** (2.2E-04)
Airline-market fixed effect	Frequency	-0.001** (2.0E-04)	-0.331** (0.131)	-0.001** (2.7E-04)
	Size	-2.2E-04 (1.8E-04)	0.022 (0.045)	3.9E-04* (2.2E-04)

b) Pre-merger sub-sample

	Dependent Variable	AMMC	RMMC	AvgMMC
Market fixed effects	Frequency	6.3E-04 (6.8E-04)	0.852** (0.093)	-0.003** (0.001)
	Size	-8.0E-04* (4.5E-04)	0.011 (0.071)	-7.5E-04 (8.9E-04)
Airline-market fixed effect	Frequency	-0.001** (2.5E-04)	-0.070 (0.110)	-0.001** (2.2E-04)
	Size	3.5E-05 (3.8E-04)	-0.053 (0.111)	2.5E-04 (4.5E-04)

c) Post-merger sub-sample

	Dependent Variable	AMMC	RMMC	AvgMMC
Market fixed effects	Frequency	-3.5E-04 (5.0E-04)	0.5589** (0.120)	-0.003** (7.2E-04)
	Size	-3.5E-04 (2.5E-04)	0.2385** (0.084)	-0.001** (4.4E-04)
Airline-market fixed effect	Frequency	-7.5E-04 (5.6E-04)	-0.661** (0.129)	-8.3E-04 (5.8E-04)
	Size	-7.5E-04** (2.5E-04)	-0.158 (0.110)	-8.6E-04** (3.4E-04)

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. Observations for monopoly markets have been excluded
3. White robust standard errors in parentheses
4. Same control variables as those reported in all other specifications were used
5. Goodness of fit measures (adjusted R-squared) are similar to those reported in tables 3-7
6. Statistical significance: * - 10%; ** - 5%

Table 3 Results for All Markets

Variables	Market Fixed Effects			Airline-Market Fixed Effects		
	Year before – year after merger		One-two years before – one-two years after merger	Year before – year after merger		One-two years before – one-two years after merger
	Frequency	Size	Frequency	Frequency	Size	Size
Constant	0.941** (0.407)	4.972** (0.565)	2.466** (0.321)	0.746** (0.355)	5.066** (0.638)	4.956** (0.226)
Average per capita income	4.4E-05** (8.0E-06)	1.4E-05 (1.2E-05)	2.4E-05** (3.7E-06)	4.1E-05** (9.0E-06)	8.8E-06 (1.2E-05)	-3.2E-07 (2.1E-06)
Average population	1.1E-06** (1.0E-07)	1.3E-08 (1.0E-07)	8.8E-07** (9.4E-08)	1.1E-06** (1.1E-07)	-2.5E-08 (5.9E-08)	2.7E-08 (3.1E-08)
Route HHI	-0.436** (0.195)	-0.827** (0.172)	-0.465** (0.122)	-0.219 (0.264)	-0.935** (0.203)	-0.628** (0.143)
Post-merger	-0.264** (0.029)	-0.108** (0.048)	-0.341** (0.029)	-0.244** (0.039)	-0.074 (0.056)	-0.035* (0.018)
Non-monopoly route	-0.589** (0.102)	-0.325** (0.077)	-0.549** (0.063)	-0.239** (0.115)	-0.243** (0.097)	-0.171** (0.059)
Post-merger*Non-monopoly route	-0.064** (0.025)	0.007 (0.017)	-0.093** (0.018)	-0.081** (0.019)	0.015 (0.016)	-0.003 (0.012)
Adjusted R-squared	0.668	0.761	0.674	0.856	0.849	0.859
Number of observations	7986	7986	16051	7986	7986	16051

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. White robust standard errors in parentheses
3. Market fixed effects regressions include airline dummies; all regressions include relevant year, month, and month-year dummies
4. Statistical significance: * - 10%; ** - 5%

Table 4 Results for Markets with Non-Stop Competition - AMMC

Variables	Market Fixed Effects		One-two years before – one-two years after merger		Year before – year after merger		Airline-Market Fixed Effects		One-two years before – one-two years after merger	
	Frequency	Size	Frequency	Size	Frequency	Size	Frequency	Size	Frequency	Size
	Constant	2.047* (1.233)	5.013** (1.263)	3.576** (0.644)	4.886** (0.362)	1.741** (0.639)	4.557** (0.828)	2.648** (0.358)	4.303** (0.309)	2.648** (0.358)
Average per capita income	4.3E-05** (1.9E-05)	1.4E-06 (2.1E-05)	2.2E-05** (1.1E-05)	5.4E-06 (6.2E-06)	5.3E-05** (1.9E-05)	-7.8E-07 (1.2E-05)	2.7E-05** (5.5E-06)	2.9E-06 (4.8E-06)	2.7E-05** (5.5E-06)	2.9E-06 (4.8E-06)
Average population	4.1E-07 (2.8E-07)	2.9E-08 (2.1E-07)	2.9E-07** (1.1E-07)	1.7E-08 (6.1E-08)	5.3E-07** (1.3E-07)	1.5E-07 (1.1E-07)	5.6E-07** (1.0E-07)	1.2E-07* (6.4E-08)	5.6E-07** (1.0E-07)	1.2E-07* (6.4E-08)
Route HHI	0.058 (0.158)	-0.698** (0.213)	-0.252** (0.122)	-0.561** (0.124)	-0.562* (0.348)	-1.010** (0.242)	-0.543** (0.184)	-0.649** (0.154)	-0.543** (0.184)	-0.649** (0.154)
Post-merger	-0.172** (0.072)	-0.049 (0.097)	-0.268** (0.093)	-0.136** (0.055)	-0.233** (0.079)	-0.059 (0.063)	-0.306** (0.040)	-0.108** (0.044)	-0.306** (0.040)	-0.108** (0.044)
Multi-market contact	0.001** (5.1E-04)	1.4E-04 (3.1E-04)	-4.1E-04 (3.4E-04)	-3.3E-04* (1.9E-04)	-7.3E-04 (5.2E-04)	-2.4E-04 (2.6E-04)	-0.001** (3.8E-04)	1.8E-04 (2.3E-04)	-0.001** (3.8E-04)	1.8E-04 (2.3E-04)
Post-merger*Multi-market contact	-0.001** (3.9E-04)	2.0E-04 (2.1E-04)	-7.6E-04** (2.7E-04)	1.8E-04 (1.9E-04)	-9.8E-04** (2.9E-04)	3.7E-04** (1.4E-04)	-5.8E-04** (2.3E-04)	1.9E-04** (9.2E-05)	-5.8E-04** (2.3E-04)	1.9E-04** (9.2E-05)
Adjusted R-squared	0.493	0.687	0.513	0.694	0.861	0.901	0.849	0.898	0.849	0.898
Number of observations	3404	3404	6854	6854	3404	3404	6854	6854	3404	6854

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. White robust standard errors in parentheses
3. Market fixed effects regressions include airline dummies; all regressions include relevant year, month, and month-year dummies
4. Statistical significance: * - 10%; ** - 5%

Table 5 Results for Markets with Non-Stop Competition – RMMC and AvgMMC

Variables	Market Fixed Effects			Airline-Market Fixed Effects		
	AvgMMC		RMMC	AvgMMC		RMMC
	Frequency	Size	Frequency	Size	Frequency	Size
Constant	3.935** (0.667)	4.453** (0.475)	3.357** (0.682)	4.613** (0.517)	2.640** (0.481)	4.299** (0.162)
Average per capita income	1.9E-05* (1.0E-05)	5.7E-06 (4.9E-06)	2.1E-05* (1.2E-05)	3.2E-06 (5.2E-06)	2.7E-05** (6.4E-06)	3.2E-06 (3.8E-06)
Average population	3.5E-07** (1.3E-07)	2.6E-08 (1.1E-07)	2.7E-07** (1.3E-07)	7.6E-08 (1.1E-07)	5.6E-07** (1.1E-07)	1.2E-07** (4.4E-08)
Route HHI	-0.464** (0.147)	-0.592** (0.112)	-0.064 (0.137)	-0.527** (0.104)	-0.527** (0.165)	-0.645** (0.108)
Post-merger	-0.242** (0.089)	-0.126** (0.051)	-0.292** (0.099)	-0.158** (0.055)	-0.311** (0.060)	-0.109** (0.038)
Multi-market contact	-0.003** (5.2E-04)	-5.8E-04** (2.5E-04)	0.408** (0.076)	-0.076 (0.049)	-0.001** (4.5E-04)	2.7E-04 (2.4E-04)
Post-merger*Multi-market contact	-5.9E-04** (2.2E-04)	5.0E-05 (1.9E-04)	-0.126* (0.067)	0.190** (0.046)	-4.6E-04 (3.3E-04)	1.8E-04 (1.4E-04)
Adjusted R-squared	0.518	0.694	0.510	0.690	0.849	0.898
Number of observations	6854	6854	6854	6854	6854	6854

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. White robust standard errors in parentheses
3. Market fixed effects regressions include airline dummies; all regressions include relevant year, month, and month-year dummies
4. Statistical significance: * - 10%; ** - 5%

Table 6 All Markets, Excluding Merger Participants

Variables	Market Fixed Effects		Airline-Market Fixed Effects					
	Year before – year after merger		Year before – year after merger					
	Frequency	Size	Frequency	Size				
Constant	0.714* (0.418)	4.895** (0.603)	3.537** (0.284)	5.624** (0.230)	0.959** (0.305)	5.191** (0.659)	1.876** (0.307)	5.045** (0.250)
Average per capita income	4.7E-05** (7.7E-06)	2.5E-05** (1.1E-05)	4.3E-06* (2.6E-06)	2.4E-07 (1.7E-06)	4.5E-05** (1.0E-05)	1.1E-05 (1.3E-05)	2.2E-05** (3.5E-06)	-2.1E-07 (2.1E-06)
Average population	1.1E-06** (1.1E-07)	-3.3E-08 (8.5E-08)	6.9E-07** (9.4E-08)	-1.9E-08 (4.4E-08)	1.0E-06** (1.2E-07)	-5.6E-08 (5.3E-08)	9.7E-07** (1.1E-07)	1.3E-08 (3.2E-08)
Route HHI	-0.347** (0.164)	-1.026** (0.227)	-0.427** (0.115)	-0.846** (0.126)	-0.285 (0.231)	-1.092** (0.224)	-0.190* (0.115)	-0.701** (0.171)
Post-merger	-0.253** (0.029)	-0.143** (0.048)	-0.127** (0.019)	-0.051** (0.017)	-0.238** (0.039)	-0.087 (0.056)	-0.314** (0.025)	-0.036** (0.017)
Non-monopoly route	-0.429** (0.077)	-0.284** (0.106)	-0.455** (0.052)	-0.308** (0.056)	-0.211* (0.112)	-0.282** (0.122)	-0.160** (0.066)	-0.197** (0.076)
Post-merger*Non-monopoly route	-0.095** (0.022)	0.018 (0.016)	-0.092** (0.015)	-0.014 (0.017)	-0.093** (0.013)	0.020 (0.016)	-0.068** (0.013)	-0.003 (0.013)
Adjusted R-squared	0.733	0.784	0.714	0.792	0.868	0.847	0.850	0.855
Number of observations	6741	6741	13825	13825	6741	6741	13825	13825

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. White robust standard errors in parentheses
3. Market fixed effects regressions include airline dummies; all regressions include relevant year, month, and month-year dummies
4. Statistical significance: * - 10%; ** - 5%

Table 7 Markets with Non-Stop Competition, Excluding Merger Participants, AMMC

Variables	Market Fixed Effects			Airline-Market Fixed Effects		
	Year before – year after merger		One-two years before – one-two years after merger	Year before – year after merger		One-two years before – one-two years after merger
	Frequency	Size	Frequency	Frequency	Size	Size
Constant	1.664 (1.285)	4.572** (1.278)	3.443** (0.624)	1.876** (0.646)	4.405** (0.808)	4.197** (0.279)
Average per capita income	4.9E-05** (2.0E-05)	5.6E-07 (2.3E-05)	2.2E-05** (1.1E-05)	5.6E-05** (1.8E-05)	2.8E-06 (1.1E-05)	5.1E-06 (4.4E-06)
Average population	4.6E-07 (2.9E-07)	2.1E-07 (2.0E-07)	3.4E-07** (1.0E-07)	4.6E-07** (1.1E-07)	1.7E-07 (1.1E-07)	1.3E-07** (5.6E-08)
Route HHI	-0.020 (0.179)	-0.975** (0.262)	-0.312** (0.132)	-0.518* (0.279)	-1.132** (0.259)	-0.707** (0.187)
Post-merger	-0.227** (0.079)	-0.072 (0.098)	-0.272** (0.093)	-0.239** (0.068)	-0.077 (0.061)	-0.132** (0.039)
Multi-market contact	0.001** (4.8E-04)	-4.4E-04 (2.9E-04)	-4.2E-04 (3.7E-04)	-4.9E-04 (6.0E-04)	-2.5E-04 (3.3E-04)	1.9E-04 (2.7E-04)
Post-merger*Multi-market contact	-0.001** (3.9E-04)	4.0E-04** (2.0E-04)	-6.9E-04** (2.9E-04)	-0.001** (2.4E-04)	3.9E-04** (1.5E-04)	-7.2E-04** (2.1E-04)
Adjusted R-squared	0.574	0.731	0.568	0.872	0.901	0.897
Number of observations	2727	2727	5656	2727	2727	5656

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. White robust standard errors in parentheses
3. Market fixed effects regressions include airline dummies; all regressions include relevant year, month, and month-year dummies
4. Statistical significance: * - 10%; ** - 5%

Table 8 Estimates of Post-Merger Effect of MMC – Sub-Sample Including Years 2003 and 2007

	Dependent Variable	AMMC* (Year 2007)	RMMC* (Year 2007)	AvgMMC* (Year 2007)
Market fixed effects	Frequency	-2.3E-04 (3.6E-04)	-0.202** (0.094)	-4.3E-04 (3.5E-04)
	Size	1.2E-04 (2.9E-04)	0.154* (0.084)	-3.3E-04 (-2.9E-04)
Airline-market fixed effect	Frequency	-2.8E-04 (3.0E-04)	-0.107* (0.066)	-2.4E-04 (3.2E-04)
	Size	-3.0E-05 (1.3E-04)	0.142** (0.037)	-4.8E-05 (1.9E-04)

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. Regressions excluding observations for monopoly markets
3. White robust standard errors in parentheses
4. Same control variables as those reported in all other specifications were used
5. Goodness of fit measures (adjusted R-squared) are similar to those reported in tables 3-7
6. Statistical significance: * - 10%; ** - 5%

Table 9 Robustness Checks

a) All markets

Model	Time	Dependent Variable	Later Year	Non-monopoly route	Later Year*Non-monopoly route	Adjusted R-squared
Market fixed effects	Before merger (2003 vs. 2004)	Frequency	-0.100** (0.041)	-0.485** (0.092)	-0.027 (0.024)	0.720
		Size	-0.079** (0.022)	-0.437** (0.093)	-0.012 (0.018)	0.821
	After merger (2006 vs. 2007)	Frequency	-0.061** (0.013)	-0.681** (0.087)	-0.018 (0.019)	0.685
		Size	0.025 (0.019)	-0.305** (0.072)	-0.064** (0.017)	0.788
Airline-market fixed effects	Before merger (2003 vs. 2004)	Frequency	-0.103* (0.063)	-0.174** (0.058)	0.010 (0.015)	0.892
		Size	-0.073** (0.031)	-0.180* (0.103)	-9.0E-04 (0.013)	0.922
	After merger (2006 vs. 2007)	Frequency	0.034 (0.024)	-0.156** (0.067)	-0.052** (0.016)	0.883
		Size	-0.072** (0.012)	-0.201 (0.132)	0.003 (0.019)	0.898

b) Markets with non-stop competition, AMMC

Model	Time	Dependent Variable	Later Year	Multi-market contact	Later Year* Contact	Adjusted R-squared
Market fixed effects	Before merger (2003 vs. 2004)	Frequency	-0.207* (0.126)	0.001 (0.001)	6.3E-04 (5.8E-04)	0.461
		Size	-0.066 (0.064)	-0.001 (8.4E-04)	4.6E-04 (3.9E-04)	0.673
	After merger (2006 vs. 2007)	Frequency	-0.082 (0.081)	-3.0E-04 (5.5E-04)	-9.1E-05 (3.9E-04)	0.504
		Size	8.9E-04 (0.060)	-3.5E-04 (3.3E-04)	1.5E-05 (2.5E-04)	0.666
Airline-market fixed effects	Before merger (2003 vs. 2004)	Frequency	-0.053 (0.064)	-0.001** (4.7E-04)	4.2E-04 (3.1E-04)	0.891
		Size	-0.108** (0.053)	-5.4E-05 (4.8E-04)	1.3E-04* (7.6E-05)	0.912
	After merger (2006 vs. 2007)	Frequency	-0.078* (0.040)	-6.6E-04 (6.4E-04)	-1.4E-04 (1.8E-04)	0.900
		Size	0.001 (0.032)	-6.8E-04** (2.5E-04)	-1.2E-04 (1.0E-04)	0.921

c) Markets with non-stop competition, RMMC

Model	Time	Dependent Variable	Later Year	Multi-market contact	Later Year* Contact	Adjusted R-squared
Market fixed effects	Before merger (2003 vs. 2004)	Frequency	-0.076 (0.080)	0.902** (0.091)	-0.072 (0.058)	0.548
		Size	-0.162** (0.058)	-0.036 (0.062)	0.068 (0.077)	0.718
	After merger (2006 vs. 2007)	Frequency	-0.104 (0.079)	0.549** (0.133)	0.018 (0.088)	0.507
		Size	-0.013 (0.060)	0.197** (0.088)	0.076 (0.062)	0.667
Airline-market fixed effects	Before merger (2003 vs. 2004)	Frequency	-0.067 (0.085)	-0.209** (0.082)	0.131 (0.088)	0.891
		Size	-0.115 (0.075)	-0.131 (0.097)	0.073* (0.038)	0.912
	After merger (2006 vs. 2007)	Frequency	-0.065** (0.032)	-0.618** (0.112)	-0.071 (0.042)	0.903
		Size	-0.003 (0.023)	-0.148 (0.108)	-0.016 (0.042)	0.920

Notes:

1. Natural logarithms of frequency and size were used as dependent variables
2. White robust standard errors in parentheses
3. Same control variables as those reported in all other specifications were used
4. Statistical significance: * - 10%; ** - 5%