Competitive Effects of Common Ownership: Evidence from the Airline Industry

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PRELIMINARY. COMMENTS WELCOME.

Abstract

We provide evidence that common ownership of firms by diversified institutions affects pricing in the product market. We identify the effect of common ownership on airfares by exploiting differences across airline routes in the evolution of common ownership over time, which allows controlling for market-carrier and year-quarter fixed effects, and for time-varying market characteristics. To address reverse causality and other endogeneity concerns, we use an instrumental variables strategy that exploits the variation in common institutional ownership across routes generated by BlackRock's acquisition of Barclays Global Investors in 2009. Our results call attention to a hidden social cost – reduced product market competition – that accompanies the private benefits of shareholder diversification and good governance.

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1 Introduction

Institutional investors own a large and increasing share of U.S. publicly traded companies. As of September 2008, institutions owned more than 78 percent of the value of U.S. equities.[1] In increasingly many cases, an institutional investor is the single largest shareholder in America's largest corporations.[2] The increasing incidence of high fractions of institutional corporate ownership has moved institutions in the focus of the corporate governance debate.[3] In this paper, we investigate the link between this debate and industrial organization by studying the effect of common ownership of firms by diversified institutions on product pricing. We use the airline industry as a case study because institutional features and data availability enable us to more cleanly identify the effect than would be possible in other industries. The conceptual insight is, however, universally applicable.

Because institutional investors tend to be highly diversified, they mechanically hold firms of the same industry that are natural competitors. We refer to such links as "common ownership of firms by diversified institutions," to distinguish this concept from more widely studied cross-ownership links, in which two competing firms mutually hold each others' shares. These common ownership links create incentives to unilaterally increase prices, moving price levels further towards a monopolistic outcome: under separate ownership, each firm has an incentive to lower prices or increase quantity to gain market share at the expense of its rivals. Under common ownership, that incentive is weaker, because shareholders internalize to some extent the decrease in profits in the other companies in their portfolio.[4]

Antitrust law provides limited guidance on the issue of partial acquisitions, and the

[1] See McCahery, Starks, and Sautner (2011).

[2] See the title story of The Economist, December 7, 2013: "The rise of BlackRock."

[3] See, for example, Katz and McIntosh (2013); Brav, Jiang, Partnoy, and Thomas (2008); Brav, Jiang, and Kim (2011); Massa and Žaldokas (2013); Matvos and Ostrovsky (2008); Harford, Jenter, and Li (2011).

[4] See, for example, Gordon (1990) and O'Brien and Salop (2000).

subject continues to be the subject of legal debate. Section 7 of the Clayton Act forbids the acquisition of "any part" of the stock of a company if the effect were to "substantially lessen competition." An exemption is included, however, to entities "purchasing such stock (i) solely for investment and (ii) not using the same by voting or otherwise to bring about, or in attempting to bring about, the substantial lessening of competition."[5] Subsequent regulation has clarified the "solely for investment" exemption, although its interpretation continues to be the subject of legal debate. It is agreed, for example, that starting proxy fights or nominating directors for the board would render the exemption inapplicable.[6] While institutional investors therefore rarely attempt to nominate directors for company boards, it is common for investors to engage "behind-the-scenes" with management to discuss company policies on a regular basis.[7] Behind-the-scenes engagement provides a way for institutional shareholders to influence management, and therefore gain influence over corporate strategy.[8]

[5]From O'Brien and Salop (2000): "[t]he courts have read this solely-for-investment exemption in two parts. First, the defendant must show that it made the stock acquisition solely for 'investment', a term not defined in the statute. Second, if that showing has been made, the plaintiff carries the burden of establishing that the stock is being used to bring about or attempt to bring about a substantial lessening of competition."

[6]O'Brien and Salop (2000) refer to 43 Fed. Reg. 33,450, 33,465 (1978), according to which the following actions could be viewed as rendering the "solely for investment" exemption inapplicable: "(1) Nominating a candidate for the board of directors of the issuer; (2) proposing corporate action requiring shareholder approval; (3) soliciting proxies; (4) having a controlling shareholder, director, officer, or employee simultaneously serving as an officer or director of the issuer; (5) being a competitor of the issuer; (6) doing any of the foregoing with respect to any entity directly or indirectly controlling the issuer."

[7]McCahery, Starks, and Sautner (2011): "we find that the majority of institutional investors that responded to our survey are willing to engage in shareholder activism. Their preferred methods would be, first, to vote with their feet (i.e., simply sell the shares), second, to vote against the company at the annual meeting, and third, to engage in discussions with the firm's executives."

[8]For example, BlackRock's Proxy Voting and Shareholder Engagement FAQ (updated February 2014) states that "We engaged with roughly 1500 companies around the world in 2012. When we engage successfully and companies adjust their approach, most observers are never aware of that engagement. As a long-term investor, we believe it pays to be patient (and persistent) in achieving the outcome that is most consistent with the economic interests of our clients. We sometimes support management on issues in the short term while they work through changes over the long-term. We typically only vote against management when direct engagement has failed. At BlackRock, engagement encompasses a range of activities from brief conversations to a series of one-on-one meetings with companies. In essence though, it is about communicating to companies our concerns about issues that have the potential to materially impact long-term economic performance. Our preferred approach is to encourage companies to change their practices where we feel it is needed, rather

Because behind-the-scenes engagement is private, it is difficult for regulators to limit the range of topics that can be discussed during engagement, which of course could potentially include pricing strategy or other corporate strategies that may raise competitive concerns. Note that investors need not actively influence management to compete less aggressively; they may do so in indirect ways by simply failing to enforce fierce competition. Also note that the accumulation of a portfolio with common ownership links happens as a mechanical consequence of diversification, or by construction for an index fund.

Whether these considerations are of practical importance is an empirical question. Is the incentive to unliaterally increase prices implied by ownership by diversified institutions strong enough to affect competition? In this paper, we empirically investigate the competitive effects of ownership by diversified institutional investors on prices using the airline industry as a case study. The airline industry is useful for this purpose due to the availability of detailed data on market structure and prices for a relatively long period of time. In particular, the fact that we can calculate the extent of common ownership at the route level over time allows us to control for a wealth of confounding factors with fixed effects. As an illustrative example, our empirical strategy compares the impact of an increase of common ownership on the New York (JFK)-San Francisco (SFO) route relative to other routes on pricing, controlling for route-carrier characteristics that are constant over time, time-varying variables that are constant across routes, such as oil prices and other cost-shifters, and market characteristics that can be time-varying, including measures of market concentration and presence of low-cost carriers.

We start our analysis by calculating adjusted indices of market concentration at the

than to divest their shares (which is, in any case, not generally possible for our passively managed or index funds). Our engagement activities make an important contribution toward fulfilling our fiduciary duty to fund investors to protect and enhance *their* long-term economic interests in the companie*s* in which we invest on their behalf." (emphasis is ours).

route level that take into account common ownership by institutions. This adjusted index is the modified Herfindahl-Hirschman index (MHHI) developed by Bresnahan and Salop (1986) and O'Brien and Salop (2000), and a direct measure of the incentive of airlines to unilaterally increase prices in a given market. The average MHHIs across routes are markedly higher than the corresponding HHIs that do not take into account common ownership.[9] The increase in incentives due to common ownership is more than 10 times larger than what would raise 'significant anti-competitive concerns' of anti-trust agencies according to the 2010 horizontal merger guidelines. Yet, MHHI delta is thus far not explicitly taken into account in anti-trust regulation (except with respect to direct, horizontal, cross-ownership links). The documentation of these anti-competitive incentives is the first contribution of this paper. Answering whether these incentives translate into higher product prices is the second step of our analysis.

Following O'Brien and Salop (2000), we call the difference between MHHI and HHI, which is a measure of the incentives to increase prices in a route because of the common ownership channel, the "MHHI delta." We now estimate the effect of the MHHI delta on average ticket prices in a given market, controlling for quarter and route-carrier fixed effects. Under the null hypothesis that common ownership links do not affect corporate strategy, the MHHI delta does not affect pricing. In other words, the multiple-differences approach described above should yield insignificant results for the effect of the MHHI delta on prices. However, we find a statistically and economically significant effect of MHHI delta on average fares, and thus reject the null hypothesis. Moreover, we find that the effect of common ownership on prices is higher in markets that are more concentrated (as measured by the HHI).

[9]The HHI (Herfindahl-Hirschman Index) is a commonly used measure of market concentration in industrial organization. It is calculated as the sum of market shares squared in a given market. In a Cournot oligopoly model, the HHI is proportional to the average Lerner index of the firms in the market.

To address reverse causality and other endogeneity concerns, we exploit a natural experiment created by the acquisition of Barclays Global Investors by BlackRock in 2009. The acquisition generated variation in MHHIs across routes, and presumably happened for reasons unrelated to the pricing in the airline industry. It therefore allows us to use an instrumental variables strategy to identify the effect of the MHHI delta on average fares. The estimates of the effect of common ownership on fares from these panel IV regressions are qualitatively consistent with our baseline results, but significantly higher quantitatively.

In sum, we find evidence from the U.S. airline industry that common ownership by diversified institutions that maximize their shareholders' interests adversely affect product market competition. These results are consistent with the theory of oligopoly under different ownership arrangements developed by O'Brien and Salop (2000), both in the sense that the differences between MHHIs and HHIs are large and significant, and that the estimated effect of common ownership on prices is statistically and economically significant.[10]

Our results have clear implications for antitrust evaluation of mergers between asset managers. In particular, antitrust agencies need to consider not only the effects in terms of higher concentration in the market for asset management, but also how the common ownership links between the portfolio companies owned by the asset managers will change. The changes in common ownership and their competitive implications can be quantified using MHHIs and modified pricing pressure indices as developed by O'Brien and Salop (2000) and empirically evaluated in this study.

However, without further assumptions, it is not clear whether preventing common ownership of firms by institutions is welfare enhancing, or whether limiting the price impact of

[10] We cannot test directly for the channel through which ownership by diversified institutions affects pricing, due to the private nature of "behind-the-scenes" engagement of institutional investors. However, the evidence we present is consistent with the hypothesis that "good corporate governance" of the affected firms makes firm strategy effectively reflect shareholders' interests, but may come at the expense of consumers.

these ownership links would be. Indeed, we propose that the anticompetitive effects of ownership by diversified institutions create a regulatory trilemma. It is not possible to design an economic system that satisfies the following three axioms: portfolio diversification of shareholders, shareholder value maximization, and product market competition. In other words, the competitive concerns caused by ownership by diversified institutions have to be weighed against the otherwise beneficial role that institutional investors play in providing diversification benefits to investors, as well as against the private and social benefits of good corporate governance in terms of improved efficiency. The magnitude of these benefits depends on multiple factors, including the degree to which more competition enhances operational efficiency of firms, and including heterogeneity across individuals in their consumption and investment behavior. We conclude that the welfare effects of shareholder diversification, competition, and good governance cannot be studied in isolation.

The paper proceeds as follows. Section 2 relates our paper to the existing literature. Section 3 reviews the theory of O'Brien and Salop (2000) and their derivation of the modified HHI. Section 4 describes the data and empirical methodology. Section 5 presents the results. Section 6 concludes.

2 Literature Review

Our paper builds on a large literature on the competitive effects of cross-ownership and common ownership. This literature has thus far been mostly theoretical. Reynolds and Snapp (1986) and Bresnahan and Salop (1986) extend classical oligopoly models to allow firms to hold shares in competitors. In this context, Bresnahan and Salop (1986) introduce the modified Herfindahl-Hirschman index (MHHI) in the context of horizontal joint-ventures, as

a way to quantify their competitive effects. O'Brien and Salop (2000) develop a more general version of the MHHI that applies to a variety of ownership structures, including the case in which shareholders invest in competing firms in the industry. It is this version of the MHHI that is relevant in the context of this paper. Complementing the above contributions, Gilo, Moshe, and Spiegel (2006) show theoretically that partial cross-ownership of firms in rivals can facilitate tacit collusion when firms interact repeatedly, in the sense that a collusive outcome can be sustained for lower values of firms' discount factors. We use the insight that incentives to compete are weakened when rival firms have common owners.

Empirically, several papers have studied networks of common ownership generated by diversified institutional investors (see for example, Davis, 2008, Vitali, Glattfelder, and Battiston, 2011, Azar, 2012, and Davis, 2013). Some papers have studied the effect of common ownership by institutional investors on measures of firm profitability (see Azar, 2012) and on market shares (see He and Huang, 2014). Brito, Ribeiro, and Vasconcelos (2014) develop a methodology for merger simulation analysis in the context of partial acquisitions, and apply the methodology to the wet shaving industry.[11] Our paper differs from this literature in that it conducts an empirical industry study on the effect of institutional holdings on prices, being the first of its kind to our knowledge.

The present paper also speaks to the finance literature as it concerns the impact of institutional investors on corporate governance. Several papers have found that institutional investor presence is associated with higher performance sensitivity of executive pay, and higher levels of CEO turnover (see, for example, Hartzell and Starks, 2003 and Kaplan and Minton, 2012). Matvos and Ostrovsky (2008) find that institutional investors holding shares in an acquiring firm are more likely to vote in favor of an acquisition if they hold shares

[11] **?** investigate the effects of a *lack* of portfolio diversification on behalf of private firms' owners on investment and operating strategies.

in the target firm. Harford, Jenter, and Li (2011), however, show that cross-ownership links by "activist" institutional investors are not by themselves high enough to justify voting in favor of the acquisition. Massa and Žaldokas (2013) study the effect of multiple blockholdings on financial conditions of co-owned firms, and find that an increase in the credit risk of a co-owned firm increases the credit risk of linked firms. Brav, Jiang, Partnoy, and Thomas (2008) and Brav, Jiang, and Kim (2011) study the financial and real effects of hedge fund activism.

Finally, the paper is also related to the empirical literature on the effect of market structure on pricing in the airline industry. Brueckner, Lee, and Singer (2013) provide a comprehensive study of the effect of market characteristics on fares in airline markets, taking into account the effect of low cost carriers, adjacent competition, and potential entry; see also Goolsbee and Syverson (2008) and Dai, Liu, and Serfes (2014). Several papers study the effect of airline mergers on competition. See, for example, Borenstein (1990), Werden, Joskow, and Johnson (1991), Kim and Singal (1993), Peters (2006), and Luo (2014). Our paper differs starkly in that it considers the impact of common ownership on airline pricing.

3 Theory: Brief Review of O'Brien and Salop (2000)

O'Brien and Salop (2000) develop a model of oligopoly in which firms, in accordance with their shareholders' incentives, maximize a weighted sum of the profits of their shareholdings, where a shareholder's weight in a firm is proportional to the fraction of the control of the firm held by that shareholder. The O'Brien and Salop (2000) model provides the basic theoretical framework for our empirical analysis of the price effects of common ownership in the airline industry. For this reason, in this section we provide a brief review of the model, and in

particular of the derivation and interpretation of the modified Herfindahl-Hirschman Index (MHHI) in a Cournot setting.

There are N firms and M owners. Ownership and control may be different, so that a given shareholder may have a higher or lower share of the control of the firm than its ownership share. The ownership share of firm j owned by owner i is β_{ij}, and the control share of firm j held by owner i is γ_{ij}. Total profits of owner i are given by $\pi^i = \sum_k \beta_{ik}\pi_k$, where π_k are the profits of firm k. Firm j maximizes a weighted average of shareholder profits, where the weights are given by the control weights γ_{ij}. Thus, maximization problem of firm j is

$$\max_{x_j} \Pi_j = \sum_{i=1}^{M} \gamma_{ij} \sum_{k=1}^{N} \beta_{ik}\pi_k, \tag{1}$$

where x_j is the strategy of firm j.

To make this formula easier to interpret, we can change the order of the sums, take π_k out of the second sum, and divide by $\sum_i \beta_{ij}\gamma_{ij}$ to rewrite the objective function as

$$\max_{x_j} \Pi_j = \pi_j + \sum_{k \neq j} \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}} \pi_k. \tag{2}$$

Thus, firm j maximizes its own profits plus a linear combination of the profits of other firms that its shareholders hold stakes in. The weight that firm j puts on the profits of firm k in its objective function relative to its own profits is given by $\frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}$. Thus, the latter ratio provides an economically meaningful measure of how connected two firms are in terms of interlocking shareholdings. Note that the weights are asymmetric, and thus the weight that firm j gives to firm k in its objective function will in general be different from the weight that firm k gives to firm j.

Applying the model in a Cournot setting, the objective function of firm j is given by

$$\max_{x_j} \Pi_j = \sum_{i=1}^{M} \gamma_{ij} \sum_{k=1}^{N} \beta_{ik} \left[P(X) x_k - C_k(x_k) \right], \tag{3}$$

where $P(X)$ is the inverse demand function for the homogeneous good, x_k is the quantity produced by firm k.[12] The first-order conditions are

$$\sum_{i=1}^{M} \gamma_{ij} \left\{ \beta_{ij} \left[P(X) - C_j'(x_j) \right] + \sum_{k=1}^{N} \beta_{ik} P'(X) x_k \right\} = 0. \tag{4}$$

This is a weighted average of the first-order condition for the maximization of the profits of each shareholder, where the weights are the control shares γ_{ij}. Each shareholder balances the benefit of a marginal increase in quantity, $\beta_{ij} \left[P(X) - C_j'(x_j) \right]$ with the cost in terms of reduced prices $\sum_{k=1}^{N} \beta_{ik} P'(X) x_k$. Note that the expression for the cost implies that the shareholders internalize the effect of reduced prices on the profits of all the firms in their portfolios.

It can be shown by algebraic manipulation of the first-order conditions that in equilibrium the market share-weighted average markup in the industry is given by

$$\sum_j s_j \frac{P - C_j'(x_j)}{P} = \frac{1}{\eta} \left[\sum_j \sum_k s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \right], \tag{5}$$

where η is the price elasticity of demand, and s_j is the market share of firm j.

In a classic Cournot setting, with separately owned firms, the market share-weighted average markup is proportional to the Herfindahl-Hirschman Index (HHI), equal to $\sum_j s_j^2$. This provides a theoretical justification for the use of the HHI as a measure of market power.

[12] While airlines set prices, one can think of the Cournot model of quantity competition as a reasonable way to model the strategic interaction of firms in airline markets, given that airlines need to make capacity commitments. Kreps and Scheinkman (1983) show that price competition with quantity pre-commitment yields a Cournot outcome under mild assumptions.

Under more general ownership structures, O'Brien and Salop (2000) propose to use the MHHI, defined as

$$MHHI = \sum_j \sum_k s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}, \tag{6}$$

as a measure of market power. The MHHI can be rewritten as

$$MHHI = HHI + \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}. \tag{7}$$

The second term in the last expression is the difference between the MHHI and the HHI, referred to as the MHHI delta or Δ. The MHHI delta quantifies the economic incentives for shareholders to increase prices unilaterally due to common ownership. Note that the MHHI is equal to the HHI when firms are separately owned.[13]

Our main hypotheses are:

H0: Common ownership by diversified institutions, as summarized by the MHHI delta, has no effect on airline prices.

H1: Common ownership by diversified institutions, as summarized by the MHHI delta, has a positive effect on airline prices.

[13] We can also interpret the MHHI delta in terms of the network of interlocking shareholdings that common ownership generates. In particular, the MHHI delta can be interpreted in terms of a weighted density (where firm-pairs are weighted by the product of their market shares, so that pairs of larger firms have higher weights) of a weighted and directed network of interlocking shareholdings. That is, instead of assuming that firms are either connected or not connected, as in unweighted networks, the intensity of connection between to firms is continuous (that is, it is a weighted network). The network is directed because the connection weight from firm k to firm j can be different from the connection weight from firm j to firm k. The intensity interlocking shareholder network connection from firm k to firm j is given by the weight that firm j gives to the profits of firm k in its objective function relative to its own profits $\frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}$. To make the weights add to one, and thus obtain a proper network density, the MHHI delta needs to be normalized by multiplying it by $(1 - HHI)^{-1}$.

4 Data and Empirical Method

4.1 Data

4.1.1 Airline Pricing and Market Shares

The markets we consider are origin-destination airport pairs, regardless of direction. We construct fares and revenue shares for each market using the publicly available Department of Transportation's Airline Origin and Destination Survey (DB1B) database, which contains a quarterly 10% sample of airline tickets.

The DB1B database includes the origin, destination, and price paid for a ticket, as well as how many passengers traveled on that ticket. In addition, it contains the operating and marketing carrier for each separate coupon of a ticket. We assign a ticket to the ticketing carrier as long as the ticketing carrier is the same for all coupons on the ticket. Code share tickets are thus attributed to the ticketing partner, and tickets with multiple ticketing carriers are dropped.[14] We also apply a number of other filters to screen out tickets that cannot readily be assigned to a particular market, or that contain unreliable information.[15]

To eliminate a large number of tiny markets, we focus our analysis on markets with more than 1800 passengers per quarter, which corresponds to an average of at least than 20 passengers a day. We retain over 1 million observations at the carrier-market-quarter

[14] Alternatively, one could attribute a ticket to the operating carrier. In the data available to us, the operating carrier is often a regional affiliate of a major airline, and we thus prefer to use the ticketing carrier.

[15] We only include tickets with at most one directional break, and with at most three coupons in each direction. We also exclude (1) round-trip tickets that do not return to their origin airport (so called "open-jaw" tickets), (2) tickets that include a surface segment, (3) tickets on which the origin or destination are also visited as intermediary airports. We split round-trip tickets into the inbound and the outbound itinerary, and treat each itinerary as a separate one-way ticket. We divide the price for roundtrip tickets equally between the inbound and the outbound itinerary to yield the "one-way equivalent" price. We exclude tickets with a one-way equivalent fare below $25 or above $2,500 (in 2008 dollars), or with fares that are flagged as "not credible" by the DOT. We exclude charter and non-US airlines as they are not competing for regularly scheduled service on US routes.

level. Table 1 shows the summary statistics for our sample, both at the carrier-market and at the market level. The average fare per passenger across markets is $217. (All fares are adjusted to 2008 dollars using the CPI.) Average quarterly passengers are about 3,720 per carrier and market and about 18,323 per market. The HHIs are calculated based on revenue shares of ticketing carriers, and average 5,200 across markets. On average around two-thirds of passengers in a given market using connecting flights.

We experiment with a number of additional control variables. We used the T100 data published by the DOT to construct the number of nonstop carriers serving the market, and whether Southwest or other low cost carriers (LCCs) are serving the market nonstop.[16] On average, there are 0.8 nonstop carriers in our sample markets. Southwest is competing nonstop in 9% of markets, and other LCCs are competing nonstop in 8%.

We use data on population and per capita personal income for the metro areas at the market endpoints from the Bureau of Economic Analysis. For each market in our sample, we compute the geometric mean across the metro areas at the end points to capture the population and income per capita in the market. The average "market population" is 2.3 million and and the average "market income" is about $41,000.[17]

4.1.2 Data on Airline Ownership

To construct institutional common ownership variables, we use data on institutional holdings from the Thomson-Reuters Spectrum dataset on 13F filings. This dataset includes

[16]The T100 database contains information on scheduled and performed flights by operating carrier. We count a ticketing carrier as competing nonstop in a market if they ticket at least one coupon in the DB1B data for which the operating carrier is operating nonstop in the market according to the T100 database. We count an operating carrier to be operating nonstop in a market and quarter if they performed at least 60 flights in each direction during the quarter. We count Southwest or another low cost carrier to be serving a market nonstop if they perform at least 24 flights in each direction.

[17]Since we only have quarterly population and income data until the end of 2012 we repeat the values for 2012 quarter 4 for 2013 quarter 1 .

institutional holdings for all firms publicly traded in U.S. stock markets. All institutional investors managing more than $100 million must file a 13F form disclosing their holdings to the SEC. The Thomson-Reuters data identifies managers by SEC filing, assigning them a manager number.[18] It includes information on the fraction of the shares that are voting shares. We restrict the data to holdings of at least 0.5% (adding voting and non-voting shares) of shares outstanding.[19]

We also use data on non-institutional ownership that we hand-collected from SEC Proxy statements, available from the SEC website. We include non-institutional owners reported in SEC proxy statements that held 5% or more of outstanding shares in any company in our sample. We also include institutional owners from the SEC proxy statements that were not present in the Thomson data.[20]

Following Hartzell and Starks (2003), we calculate the share of institutional ownership, institutional ownership concentration (measured as the Herfindahl of the institutional ownership shares), and the fraction of total institutional ownership that is owned by the top 5 institutional owners in the firm. For the market-level regressions we calculate a passenger-weighted average of the institutional ownership variables. In the average route, institutional investors hold 65% of the shares of the carriers in the route. The average institutional ownership concentration in the average route is .04. The top 5 institutional investors hold around 50% of the total institutional holdings.[21]

[18]Some institutions have more than one manager number. We assign the same numbers in these cases based on the institution names.

[19]Holdings are not observed during bankruptcy periods. During the bankruptcies of American Airlines, Delta Airlines, Northwest Airlines, United Airlines, and US Airways, we repeat the last observed value for percentage of shares owned, to avoid large jumps in the MHHIs during these periods. We also estimate specifications excluding bankruptcy periods. The results are qualitatively similar, and we include them in the appendix.

[20]We add owners from the SEC filings to our dataset for the year of the corresponding shareholder meeting.

[21]These numbers are somewhat higher than those reported by Hartzell and Starks (2003) for firms in all industries over the period 1991-1996. Note that only two airlines, Delta and Southwest, are members of the

4.2 Quantifying Economic Incentive Effects Using the MHHI

We use the data on market shares and percent of shares outstanding held to calculate the MHHI for each route in each quarter. We calculate the control share for shareholder i in firm j, γ_{ij}, as the percentage of the sole voting shares of firm j held by institution i. We calculate the ownership share of shareholder i in firm j, β_{ij}, as the percentage of all shares (voting and non-voting) of firm j held by institution i. As already mentioned, we exclude shareholdings with voting and non-voting shares of less than 0.5% of outstanding. This amounts to assuming that institutions with less than 0.5% have no weight in the objective function of the firm.

We calculate the MHHI at each route for each quarter between 2001Q1 and 2013Q1. Figure 1 shows the average MHHI and average HHI over time for that period.[22] The differences between the MHHI and the HHI are a measure of the market concentration that is generated by common ownership, and are economically large. The average MHHI delta was around 0.2 (2,000 on a scale from 0 to 10000) at the beginning of the period, declined to around 0.1 in 2006-2007, and then increased again to more than 0.2 in 2013.[23] Figure 2 shows histograms of the distribution of MHHI deltas across routes in 2001Q1 and in 2013Q1. The average MHHI delta is higher in 2013Q1 than in 2001Q1. The range of MHHI deltas, however, decreased, with fewer outliers in 2013Q1 than in 2001Q1.

S&P 500. Our results are therefore unlikely to be driven by cross-ownership links implied by S&P index funds.

[22]The HHI throughout the paper is expressed on a scale from 0 to 1, not from 0 to 10000. The MHHI is on the same scale. although it is possible in some cases for the MHHI to be higher than 1 if the control shares are different from the ownership shares.

[23]According to the DOJ/FTC 2010 Horizontal Merger Guidelines, in highly concentrated markets (i.e., markets with an HHI greater than 2500 on a scale from 0 to 10000), mergers involving changes in the HHI of more than 200 points (again, on a scale from 0 to 10000) are "likely to enhance maket power." Thus, the average MHHI delta in the airline industry generated by common ownership by institutional investors in 2013Q1 was more than 10 times higher than the threshold that would likely generate antitrust concerns according to the guidelines.

4.3 Baseline Regressions

We start by running a regression of the logarithm of average price for carrier j in route i at time t as a function of the HHI, the MHHI delta, market-carrier fixed effects, and additional controls:

$$\log(p_{ijt}) = \beta \cdot \Delta_{it} + \gamma \cdot HHI_{it} + \theta \cdot X_{ijt} + \alpha_t + \nu_{ij} + \varepsilon_{ijt}, \tag{8}$$

where p_{ijt} is the average price for carrier$j$ in route i at time t and Δ_{it} the MHHI delta in route i at time t, X_{ijt} is a vector of controls, α_t are time fixed effects, and ν_{ij} are market times carrier fixed effects.

Additionally, we run regressions aggregated at the market level:

$$\log(p_{it}) = \beta \cdot \Delta_{it} + \gamma \cdot HHI_{it} + \theta \cdot X_{it} + \alpha_t + \nu_i + \varepsilon_{it}, \tag{9}$$

where p_{it} is the average price in route i at time t.

As controls, we include various market characteristics: number of non-stop carriers operating in a route, an indicator for whether Southwest operates non-stop in a route, an indicator for whether another low-cost carrier (LCC) operates in a route, geometric average of the population in the two endpoints of a route, the geometric average of per capita income in the two endpoints in a route, the share of passengers in the market that travel using connecting flights, and the share of passengers for the market-carrier that travel using connecting flights (in the market-carrier level regressions).

In addition, we control for variables that capture the effect on airline pricing (if any) of institutional ownership per se. Following Hartzell and Starks (2003), we include the share of institutional ownership, institutional ownership concentration (measured as the Herfindahl

of the institutional ownership shares), and the fraction of total institutional ownership that is owned by the top 5 institutional owners in the firm. For the market-level regressions we calculate a passenger-weighted average of the institutional ownership variables.

The HHIs are potentially endogenous. However, Gayle and Wu (2012) showed that simultaneity bias is negligible, and the literature in general does not instrument (Morrison, 2001, Gayle and Wu, 2012, Brueckner, Lee, and Singer, 2013).

The MHHI deltas could be endogenous if institutions buy particular airlines when their prices (or expected prices) increase. To address this endogeneity concern, we exploit potentially exogenous variation created by the merger of two large institutional investors. We describe the methodology for this event study in more detail in the next subsection.

4.4 Exploiting Variation in MHHIs from the Acquisition of Barclays Global Investors by BlackRock

Following months of attempts by Barclays to strengthen its balance sheet, a bid by BlackRock to acquire Barclays Global Investors (BGI), the investment unit of Barclays Plc, was announced on June 11, 2009. The bid was successful and the acquisition was completed in December 2009, creating the largest asset manager globally.

Both companies held significant positions in the airline industry. As a result, the combination of the two increased MHHIs in airline markets where carriers in which BlackRock and Barclays had shareholdings were present, whereas MHHIs did not change in markets that did not have airlines held by both investors. Since it is unlikely that the airline industry played a role in decision making leading to the BlackRock-Barclays deal, the variation in MHHIs created by this acquisition is arguably a natural experiment, and can be treated as

exogenous.[24]

We exploit this variation as follows. We start by calculating the MHHI in the quarter before the acquisition was announced, 2009Q1, for each airline market. We then calculate a counterfactual MHHI for the same period with the only difference that we treat the holdings of BlackRock and Barclays in a combined way. We call the difference between the latter MHHI and the former MHHI the "implied delta". If portfolios were to remain the same after the announcement, then the change in the MHHI created by the merger would be equal to the implied delta.

Thus, we can think of the implied delta as a "treatment" variable, with markets with a high implied delta being potentially affected by the acquisition, and markets with a low implied delta being not directly affected by the acquisition. As the pre-period, we use the first quarter before the announcement, 2009Q1. As the post periods, we use 2011Q1, 2012Q1, and 2013Q1 (using the same quarter as the pre-period to control for seasonality). In a discrete treatment version, we divide markets into terciles according to their implied deltas, and assign markets in the top tercile to the treatment group, and markets in the bottom tercile to the control group. In a continuous treatment version, we use the implied delta as a continuous treatment variable. We use the treatment status interacted with a post-period indicator as an instrument for the actual MHHI delta.

Several significant confounding events occurred during the time period around the BlackRock-BGI deal. First, the Delta and Northwest merger was announced in April 2008 and became effective in September 2008. Second, the United and Continental merger was announced in May 2010 and became effective in October 2010. Finally, American Airlines filed for bankruptcy in November 2011. Markets that had a sizable share of both merging partners

[24] He and Huang, 2014 also use variation generated from institutional investor mergers and acquisitions to obtain exogenous variation in institutional common ownership.

were potentially directly affected by the mergers. We thus control for the merging parties' shares in the quarter before the merger. Markets that had a positive share of American Airlines in any quarter between 2009Q1 and 2013Q1 were potentially directly affected by the American Airlines bankruptcy, and we thus control for American's maximum share in a market between 2009 and 2013.

5 Results

Having documented that MHHI deltas are positive and large, we know that common ownership links across airlines induce substantial incentives to increase prices on selected routes. In this section, we investigate whether firms set prices consistent with these incentives.

5.1 Results from Panel Regressions

Results from our basic specifications are reported in Table 2. We use data for the period 2001Q1-2013Q1. Following Goolsbee and Syverson (2008), for the market-carrier level regressions we weight by average passengers for the market-carrier over time and cluster standard errors at the market-carrier level. For the market level regressions we weight by average passengers in the market over time and cluster standard errors at the market level.

The first specification of Table 2 reports results from a regression of log average fare by carrier-market on the MHHI delta, HHI, market-carrier fixed effects, and year-quarter fixed effects. We find a large and significant positive effect of both the HHI and the MHHI delta on average fares. An increase in the HHI from 0 to 1 (from completely unconcentrated to completely concentrated) is associated with an increase in average fares of 33%. An increase in the MHHI delta from 0 to 1 is associated with an increase in average fares of 21%. The

effect of the MHHI delta of the same order of magnitude as the widely studies effect of concentration in the product market, or HHI. [25]

In the next specification, we control for additional market characteristics: the number of nonstop carriers, a Southwest nonstop presence indicator, and other LCC nonstop presence indicator, average population of the endpoints, average income per capita of the endpoints, average share of passengers traveling using connecting flights in the market, and average share of passengers traveling using connecting flights for a given carrier in a given market. The coefficients of both the HHI and the MHHI delta are lower than in the specification without controls, but still positive and statistically and economically significant. An increase in the HHI from 0 to 1 (from completely unconcentrated to completely concentrated) is associated with an increase in average fares of 27%. An increase in the MHHI delta from 0 to 1 is associated with an increase in average fares of 13%. The coefficients on the control variables have the expected signs: A larger number of nonstop competitors, Southwest's and other LCC's nonstop presence, and a larger end point population are all associated with lower fares.

In the third specification, we add institutional ownership and institutional ownership concentration controls. The coefficients of both the HHI and the MHHI delta are essentially unchanged. A higher fraction of institutional ownership is associated with lower average fares. A higher level of institutional ownership concentration (measured either using the institutional ownership Herfindahl or using the fraction of institutional holdings held by the top 5 institutions) is associated with higher average fares.

Specification 4 to 6 are analogous to specifications 1 to 3, but aggregated at the market

[25] The coefficients reported in the table reflect the change in fare in log points when the independent variables increase by 1. The percentage change in fares is given by $e^{\beta} - 1$, which is close to the regression coefficient β.

level instead of at the market-carrier level. We find qualitatively similar results, although the coefficients of both the delta and the HHI are significantly higher at the market level than at the market-carrier level. The coefficients may be higher in this specification because it does not control for market-carrier specific factors which may affect prices in the entire market, for example whether a route is between two hubs of a given carrier.

We also study the interaction effect between common ownership and market concentration. One possible mechanism through which incentives created by common ownership could express themselves is by reducing incentives for shareholders to engage with management in order to enforce aggressive competition for market shares. Thus, one would expect collusive markets to remain collusive when common ownership is high. If this mechanism is important, one would expect the effect of the MHHI delta to be higher in highly concentrated markets than in less concentrated markets, since markets with a smaller number of firms are more likely to achieve collusion in the first place. Table 3 shows results of regressions similar to those in Table 2, but adding an interaction between the HHI and the MHHI delta. We find that the MHHI delta has no significant positive effect on average fares in markets that are completely unconcentrated, and that the effect of MHHI delta on fares is increasing in market concentration.

As a robustness check, we include distance times year fixed effect interactions, to ensure that the effect is not generated by differences in price changes over time in longer and shorter routes, for example due to a differential response to oil price changes. We include the results in the appendix.[26] The results are very similar to those of regressions without distance-time interactions.

[26]We estimate specifications interacting year fixed effects with a continuous measure of distance (average miles traveled), and specifications interacting year fixed effects with twelve distance dummy variables indicating the following distance "buckets" (in miles): 0-200, 200-500, 500-1000, 1000-1500, 1500-2000, 2500-3000, 3000-3500, 3500-4000, 4000-4500, 4500-5000, and >5000.

We ran specifications at the market-carrier level interacting both the MHHI delta and the HHI with year dummies. Figure 3 shows the results for a specification with weights and all additional controls. The effect of MHHI delta on fares is positive and statistically significant in most years, and in particular in all years since 2008. The effect of the HHI on fares is also positive and statistically significant in all years. The effect of market concentration (as measured by the HHI) on average fares is higher in the period starting in 2008 than in the previous years. Although in general the effect of the HHI is higher than the effect of the MHHI delta, this is not the case in all years, and in particular does not hold in the last two years. The years 2006 and 2007 seem to have been an unusual period. During all of 2006 and some of 2007, both Delta (the largest airline at the time) and Northwest were bankrupt. These bankruptcies may confound the effect of MHHI delta because an airline may compete differently during bankruptcy.

5.2 Results from the BlackRock-Barclays Event Study

We address endogeneity concerns by focusing on variation generated by an acquisition event of two large institutional investors. In particular, we focus on the acquisition of Barclays Global Investors by BlackRock announced in June 2009 and completed in December of the same year. As explained earlier in the paper, we calculate an "implied delta" as the difference between the MHHI in 2009Q1 treating both investors as one, and the MHHI treating them separately. We then look at changes in fares between 2009Q1 and the first quarter in 2011, 2012, 2013, or all three years combined. We also control for the Delta-Northwest and United-Continental mergers and the American Airlines bankruptcy, which all occurred during the same time frame, and could potentially impact the treatment markets differently from the control markets.

Table 4 reports the results of the panel IV estimation, using treatment times post-period as an instrument for the actual MHHI delta in panel regressions. Specifications 1 to 4 report results using the discrete treatment variable, and specifications 5 to 8 report results using the continuous treatment variable. The first stage regressions show that the instruments are strong in all cases. In the second stage, we find a positive but not significant coefficient for MHHI delta in 2011Q1, and positive and significant coefficients in 2012Q1, 2013Q1, and for all three periods combined. The estimated effect of the MHHI delta on average fares for the post-periods 2012Q1 and 2013Q1 is around 0.5. Thus, a one-standard deviation increase in the MHHI delta is associated with an increase in average fares of around 5.1%. The results using the continuous treatment are similar to the results using the discrete treatment.[27]

For comparison, we show OLS results using the same sample as in the IV regressions in Table 5. The OLS estimates of the effect of the MHHI delta on fares are positive in all specifications. The coefficient on MHHI delta is higher than in the IV results for 2011Q1, but lower in 2012Q1, 2013Q1, or for the specification including all three post-periods. This suggests that the OLS results are not overestimated due to endogeneity or reverse causality, but may rather be underestimated because of measurement error in the ownership data. The IV regressions use a well-defined variation in cross-ownership to estimate the effect, and thus avoid potential measurement error in the quarter-to-quarter fluctuations of the ownership data.

[27]It is also noteworthy that markets with a large share of United and Continental in the quarter immediately before their merger experienced large fare increases in subsequent years, while markets with larger share of Delta and Northwest immediately before their merger experienced fare reductions, if anything. Markets with a large share of American Airlines during its bankruptcy experienced fare reductions, suggesting that American was competing more aggresively during this time.

6 Conclusion

In this paper, we examine the evidence on the effect of common ownership of firms by diversified institutional investors on pricing in the airline industry. The hypothesis is that common ownership creates incentives to unilaterally increase product prices. We measure that the MHHI, a modified Herfindahl-Hirschman index that takes common ownership by institutions into account, is markedly higher than the conventional HHI in the airline industry. We then present evidence of a significant effect of common ownership on airline pricing. The effect is higher in more concentrated markets. We exploit variation in the MHHI generated by the merger of two large asset managers, and thus estimate the effect of institutional common ownership on prices using a panel IV identification strategy. This strategy alleviates endogeneity concerns that might otherwise be present in our panel estimation.

We argue that our results have direct policy implications for the evaluation of mergers involving large asset managers. In addition to evaluating potential upward pricing pressure in the market for asset management, antitrust agencies need to consider potential effects driven by changes in common ownership links of the portfolio firms owned by the asset managers.

Our results are a strong indication for the practical importance of a regulatory trilemma that arises as a result of increasing ownership of U.S. corporations by diversified institutional investors. Significant ownership of firms by diversified investors combined with the axiom of shareholder value maximization implies incentives to increase prices. The welfare effects of shareholder diversification, competition, and good governance can therefore not be studied in isolation.

References

Azar, J. (2012): "A new look at oligopoly: Implicit collusion through portfolio diversification," Ph.D. thesis, Princeton University. 2

Borenstein, S. (1990): "Airline mergers, airport dominance, and market power," *The American Economic Review*, 80(2). 2

Brav, A., W. Jiang, and H. Kim (2011): "The real effects of hedge fund activism: Productivity, risk, and product market competition," Discussion paper, National Bureau of Economic Research. 3, 2

Brav, A., W. Jiang, F. Partnoy, and R. Thomas (2008): "Hedge fund activism, corporate governance, and firm performance," *The Journal of Finance*, 63(4), 1729–1775. 3, 2

Bresnahan, T. F., and S. C. Salop (1986): "Quantifying the competitive effects of production joint ventures," *International Journal of Industrial Organization*, 4(2), 155–175. 1, 2

Brito, D., R. Ribeiro, and H. Vasconcelos (2014): "Measuring Unilateral Effects in Partial Horizontal Acquisitions," *International Journal of Industrial Organization*. 2

Brueckner, J. K., D. Lee, and E. S. Singer (2013): "Airline competition and domestic US airfares: A comprehensive reappraisal," *Economics of Transportation*, 2(1), 1–17. 2, 4.3

Dai, M., Q. Liu, and K. Serfes (2014): "Is the Effect of Competition on Price Disper-

sion Nonmonotonic? Evidence from the US Airline Industry," *Review of Economics and Statistics*, 96(1), 161–170. 2

Davis, G. F. (2008): "A new finance capitalism? Mutual funds and ownership re-concentration in the United States," *European Management Review*, 5(1), 11–21. 2

——— (2013): "After the corporation," *Politics & Society*, 41(2), 283–308. 2

Gayle, P., and C.-Y. Wu (2012): "A re-examination of incumbents' response to the threat of entry: Evidence from the airline industry," *Working Paper*. 4.3

Gilo, D., Y. Moshe, and Y. Spiegel (2006): "Partial cross ownership and tacit collusion," *The RAND Journal of Economics*, 37(1), 81–99. 2

Goolsbee, A., and C. Syverson (2008): "How do incumbents respond to the threat of entry? Evidence from the major airlines," *The Quarterly Journal of Economics*, 123(4), 1611–1633. 2, 5.1

Gordon, R. H. (1990): "Do publicly traded corporations act in the public interest?," Discussion paper, National Bureau of Economic Research. 4

Harford, J., D. Jenter, and K. Li (2011): "Institutional cross-holdings and their effect on acquisition decisions," *Journal of Financial Economics*, 99(1), 27–39. 3, 2

Hartzell, J. C., and L. T. Starks (2003): "Institutional investors and executive compensation," *The Journal of Finance*, 58(6), 2351–2374. 2, 4.1.2, 21, 4.3

He, J., and J. Huang (2014): "Product Market Competition in a World of Cross Ownership: Evidence from Institutional Blockholdings," *Available at SSRN*. 2, 24

Kaplan, S. N., and B. A. Minton (2012): "How has CEO turnover changed?," *International Review of Finance*, 12(1), 57–87. 2

Katz, D. A., and L. A. McIntosh (2013): "The Mainstreaming of Shareholder Activism in 2013," *New York Law Journal*. 3

Kim, E. H., and V. Singal (1993): "Evidence from the Airline Industry," *The American Economic Review*, 83(3), 549–569. 2

Kreps, D. M., and J. A. Scheinkman (1983): "Quantity precommitment and Bertrand competition yield Cournot outcomes," *The Bell Journal of Economics*, pp. 326–337. 12

Luo, D. (2014): "The Price Effects of the Delta/Northwest Airline Merger," *Review of Industrial Organization*, 44(1), 27–48. 2

Massa, M., and A. Žaldokas (2013): "Blocks in Multiple Firms," *Working Paper*. 3, 2

Matvos, G., and M. Ostrovsky (2008): "Cross-ownership, returns, and voting in mergers," *Journal of Financial Economics*, 89(3), 391–403. 3, 2

McCahery, J., L. Starks, and Z. Sautner (2011): "Behind the Scenes: The Corporate Governance Preferences of Institutional Investors," in *AFA 2011 Denver Meetings Paper*. 1, 7

Morrison, S. A. (2001): "Actual, adjacent, and potential competition: Estimating the full effect of Southwest Airlines," *Journal of Transport Economics and Policy*, pp. 239–256. 4.3

O'Brien, D. P., and S. C. Salop (2000): "Competitive effects of partial ownership:

Financial interest and corporate control," *Antitrust Law Journal*, pp. 559–614. 4, 5, 6, 1, 2, 3, 3, 1, 2, 3

Peters, C. (2006): "Evaluating the Performance of Merger Simulation: Evidence from the US Airline Industry," *Journal of Law and Economics*, 49(2), 627–649. 2

Reynolds, R. J., and B. R. Snapp (1986): "The competitive effects of partial equity interests and joint ventures," *International Journal of Industrial Organization*, 4(2), 141–153. 2

Vitali, S., J. B. Glattfelder, and S. Battiston (2011): "The network of global corporate control," *PloS one*, 6(10), e25995. 2

Werden, G. J., A. S. Joskow, and R. L. Johnson (1991): "The effects of mergers on price and output: Two case studies from the airline industry," *Managerial and Decision Economics*, 12(5), 341–352. 2

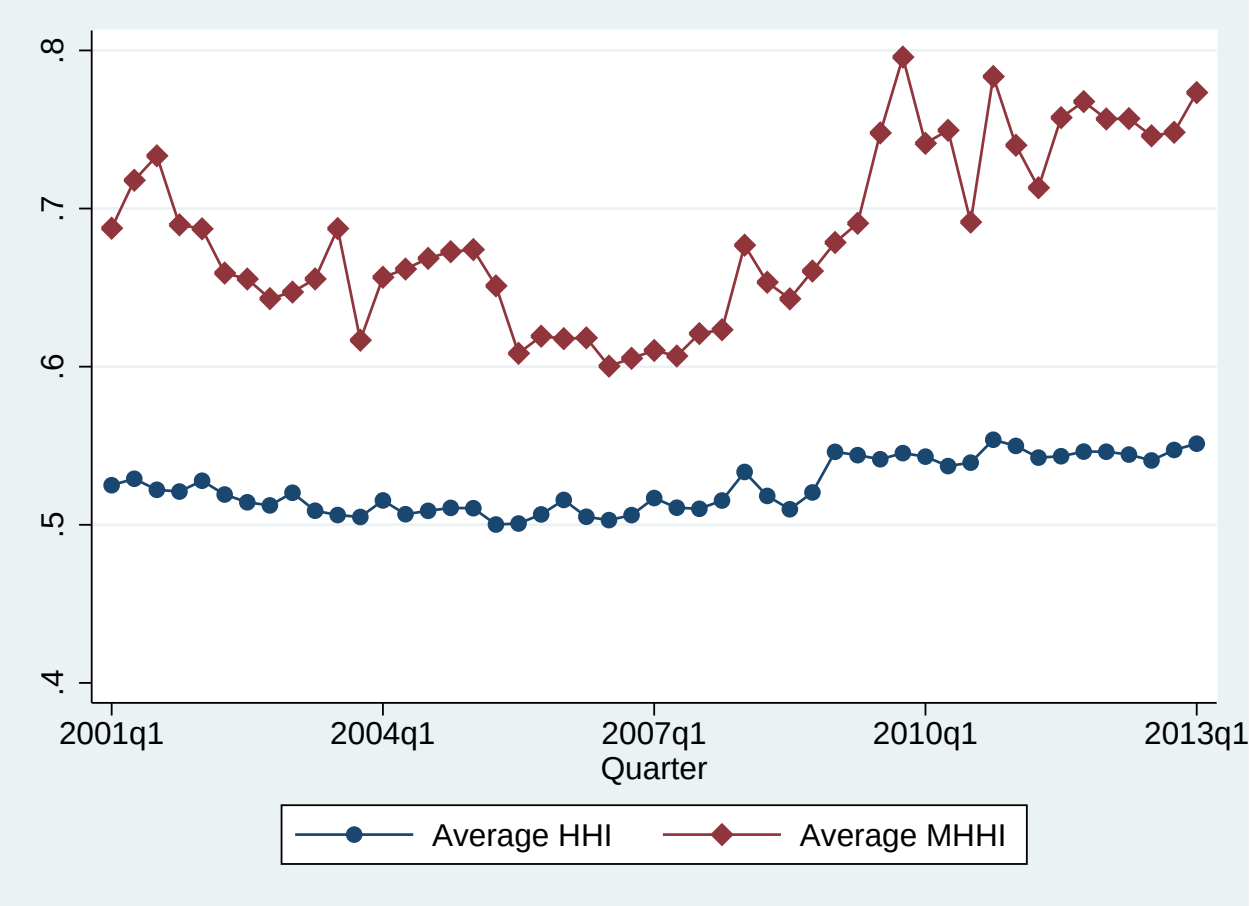

Figure 1: HHI and MHHI over time.

The HHI is the Herfindahl-Hirschman Index. We calculate the index as the sum of the market shares squared at a given route and year-quarter. We exclude international carriers and charter carriers. The MHHI is the modified HHI of O'Brien and Salop (2000). We calculate the index using the formula $MHHI = HHI + \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$, where s_j is the market share of carrier j, γ_{ij} is proportional to the voting shares of shareholder i in carrier j, and β_{ij} is the share of carrier j owned by shareholder i. The MHHI delta, which is a measure of common ownership and thus induced incentives to increase prices among airlines in a route, is the difference between the MHHI and the HHI. Averages are calculated across routes at a given point in time. We exclude routes with less than 20 passengers per day on average. Variable definitions are provided in the appendix.

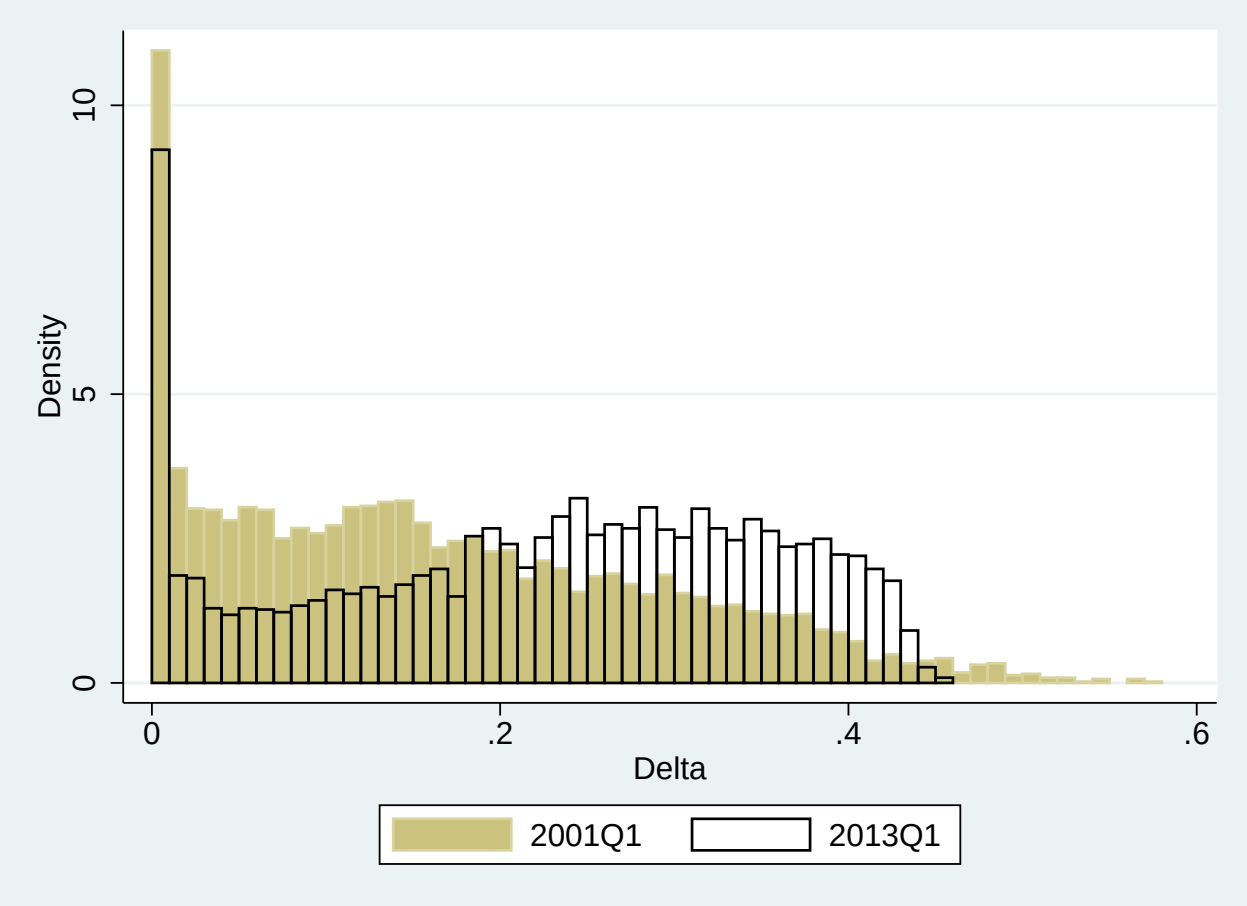

Figure 2: Distribution of MHHI delta, 2001Q4 and 2012Q4.

The MHHI delta, which is a measure of common ownership and thus induced incentives to increase prices among airlines in a route, is the difference between the MHHI and the HHI. The HHI is the Herfindahl-Hirschman Index. We calculate the index as the sum of the market shares squared at a given route and year-quarter. We exclude international carriers and charter carriers. The MHHI is the modified HHI of O'Brien and Salop (2000). We calculate the index using the formula $MHHI = HHI + \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$, where s_j is the market share of carrier j, γ_{ij} is proportional to the voting shares of shareholder i in carrier j, and β_{ij} is the share of carrier j owned by shareholder i. We exclude routes with less than 20 passengers per day on average. Variable definitions are provided in the appendix.

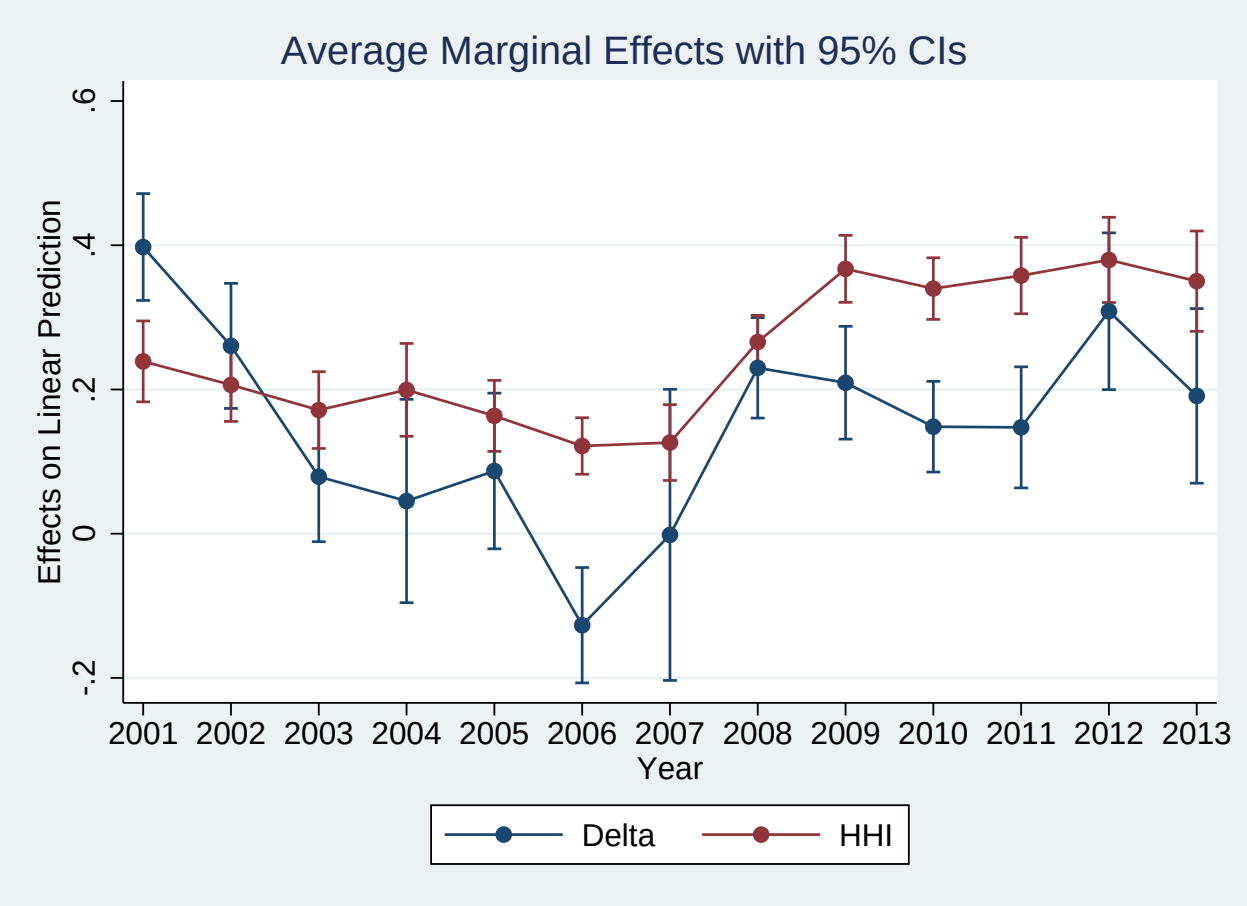

Figure 3: Estimated Effect of HHI and MHHI delta on ticket prices, by Year.

Based on a specification with market-carrier fixed effects and year-quarter fixed effects and all additional controls. Standard errors are clustered at the market-carrier level. The MHHI delta, which is a measure of common ownership and thus induced incentives to increase prices among airlines in a route, is the difference between the MHHI and the HHI. The HHI is the Herfindahl-Hirschman Index. We calculate the index as the sum of the market shares squared at a given route and year-quarter. We exclude international carriers and charter carriers. The MHHI is the modified HHI of O'Brien and Salop (2000). We calculate the index using the formula $MHHI = HHI + \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$, where s_j is the market share of carrier j, γ_{ij} is proportional to the voting shares of shareholder i in carrier j, and β_{ij} is the share of carrier j owned by shareholder i. We exclude routes with less than 20 passengers per day on average. We weight observations by average passengers of the market-carrier over time. Variable definitions are provided in the appendix.

Table 1: Summary Statistics.

The data are from the Airline Origin and Destination Survey (DB1B), 2001Q1-2013Q1. We exclude routes with less than 20 passengers per day on average. Variable definitions are provided in the appendix.

	Mean	**Std. Dev.**	**Min.**	**Max.**	**N**
Market-Carrier Level:					
Average Fare	227.03	98.94	25	2498.62	1115482
Log Average Fare	5.35	0.36	3.22	7.82	1115482
HHI	0.46	0.21	0.1	1	1115482
MHHI delta	0.17	0.1	0	0.57	1115482
Number of Nonstop Carriers	0.89	1.38	0	11	1115482
Southwest Indicator	0.09	0.29	0	1	1115482
Other LCC Indicator	0.09	0.29	0	1	1115482
Share of Passengers Traveling Connect, Market-Level	0.67	0.38	0	1	1115482
Share of Passengers Traveling Connect	0.87	0.31	0	1	1115482
Population	2.41	1.99	0.02	16.09	1089818
Income Per Capita	41.59	4.59	21.41	79.66	1089818
Average Passengers	3720	11450	10	231666	1115482
Percent Institutional Ownership	0.65	0.25	0	1.2	1115482
Institutional Ownership Concentration	0.04	0.05	0	0.96	1115482
Top 5 Holdings as Pct. of Total Institutional Holdings	0.53	0.14	0	1	1115482
Market-Level:					
Average Fare	216.9	71.86	29.66	1045.91	228890
Log Average Fare	5.33	0.33	3.39	6.95	228890
HHI	0.52	0.24	0.1	1	228890
MHHI delta	0.16	0.11	0	0.57	228890
Number of Nonstop Carriers	0.82	1.29	0	11	228890
Southwest Indicator	0.09	0.28	0	1	228890
Other LCC Indicator	0.08	0.28	0	1	228890
Share of Passengers Traveling Connect, Market-Level	0.65	0.4	0	1	228890
Share of Passengers Traveling Connect	0.65	0.4	0	1	228890
Population	2.26	1.95	0.02	16.09	222353
Income Per Capita	41.23	4.68	21.41	79.66	222353
Average Passengers	18324	33134	1800	359761	228890
Percent Institutional Ownership	0.65	0.17	0	1.2	228890
Institutional Ownership Concentration	0.04	0.04	0	0.96	228890
Top 5 Holdings as Pct. of Total Institutional Holdings	0.53	0.1	0	1	228890

Table 2: Effect of Common Ownership (MHHI delta) on Airline Prices: Panel Regressions.

Data is for the period 2001Q1-2013Q1. We exclude routes with less than 20 passengers per day on average. For the market-carrier level regressions we weight by average passengers for the market-carrier over time and cluster standard errors at the market-carrier level. For the market level regressions we weight by average passengers in the market over time and cluster standard errors at the market level. Variable definitions are provided in the appendix.

	Dependent Variable: Log(Average Fare)					
	Base			Market-level		
	(1)	(2)	(3)	(4)	(5)	(6)
MHHI delta	0.191***	0.123***	0.124***	0.283***	0.159***	0.206***
	(0.0197)	(0.0185)	(0.0186)	(0.0273)	(0.0248)	(0.0248)
HHI	0.286***	0.236***	0.235***	0.441***	0.366***	0.377***
	(0.0180)	(0.0165)	(0.0163)	(0.0259)	(0.0210)	(0.0213)
Number of Nonstop Carriers		-0.00857***	-0.00841***		-0.00673**	-0.00626**
		(0.00194)	(0.00194)		(0.00272)	(0.00272)
Southwest Indicator		-0.114***	-0.112***		-0.143***	-0.135***
		(0.00951)	(0.00949)		(0.0156)	(0.0155)
Other LCC Indicator		-0.0535***	-0.0543***		-0.0889***	-0.0936***
		(0.00649)	(0.00645)		(0.00833)	(0.00821)
Share of Passengers Traveling Connect, Market-Level		0.154***	0.154***		0.217***	0.216***
		(0.0133)	(0.0133)		(0.0153)	(0.0149)
Share of Passengers Traveling Connect		0.0675***	0.0669***			
		(0.0106)	(0.0106)			
Population		-0.0250	-0.0296		0.00662	-0.0191
		(0.0261)	(0.0262)		(0.0278)	(0.0283)
Income Per Capita		0.00443**	0.00459***		0.00436**	0.00534***
		(0.00176)	(0.00175)		(0.00202)	(0.00201)
Percent Institutional Ownership			-0.0186**			-0.156***
			(0.00723)			(0.0148)
Institutional Ownership Concentration			0.0861***			0.335***
			(0.0189)			(0.0319)
Top 5 Holdings as Pct. of Total Institutional Holdings			0.0308***			0.0735***
Year-Quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓			
Market FE				✓	✓	✓
Observations	1,115,482	1,089,818	1,089,818	228,890	222,360	222,360
R-squared	0.103	0.150	0.151	0.183	0.281	0.295
Number of Market-Carrier Pairs	50,659	49,057	49,057			
Number of Markets				7,391	7,081	7,081

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

Table 3: Interaction Effect of Institutional Common Ownership (MHHI delta) and HHI.

Data is for the period 2001Q1-2013Q1. We exclude routes with less than 20 passengers per day on average. For the market-carrier level regressions we weight by average passengers for the market-carrier over time and cluster standard errors at the market-carrier level. For the market level regressions we weight by average passengers in the market over time and cluster standard errors at the market level. Variable definitions are provided in the appendix.

	Dependent Variable: Log(Average Fare)					
	Base			Market-level		
	(1)	(2)	(3)	(4)	(5)	(6)
MHHI delta	0.0454	-0.0742*	-0.0768*	0.113*	-0.0429	-0.0175
	(0.0464)	(0.0438)	(0.0437)	(0.0606)	(0.0560)	(0.0563)
MHHI delta × HHI	0.342***	0.461***	0.471***	0.394***	0.469***	0.524***
	(0.111)	(0.104)	(0.103)	(0.143)	(0.128)	(0.123)
HHI	0.264***	0.209***	0.207***	0.417***	0.339***	0.348***
	(0.0205)	(0.0191)	(0.0189)	(0.0286)	(0.0241)	(0.0243)
Number of Nonstop Carriers		-0.00859***	-0.00844***		-0.00670**	-0.00625**
		(0.00193)	(0.00193)		(0.00268)	(0.00268)
Southwest Indicator		-0.112***	-0.110***		-0.141***	-0.133***
		(0.00949)	(0.00946)		(0.0157)	(0.0156)
Other LCC Indicator		-0.0523***	-0.0532***		-0.0876***	-0.0924***
		(0.00652)	(0.00648)		(0.00837)	(0.00825)
Share of Passengers Traveling Connect, Market-Level		0.161***	0.161***		0.224***	0.224***
		(0.0131)	(0.0131)		(0.0152)	(0.0148)
Share of Passengers Traveling Connect		0.0678***	0.0672***			
		(0.0106)	(0.0106)			
Population		-0.0232	-0.0278		0.00774	-0.0180
		(0.0261)	(0.0262)		(0.0278)	(0.0283)
Income Per Capita		0.00455***	0.00472***		0.00449**	0.00552***
		(0.00176)	(0.00175)		(0.00201)	(0.00200)
Percent Institutional Ownership			-0.0195***			-0.159***
			(0.00720)			(0.0147)
Institutional Ownership Concentration			0.0901***			0.345***
			(0.0189)			(0.0314)
Top 5 Holdings as Pct. of Total Institutional Holdings			0.0303***			0.0704***
			(0.00908)			(0.0181)
Year-Quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓			
Market FE				✓	✓	✓
Observations	1,115,482	1,089,818	1,089,818	228,890	222,360	222,360
R-squared	0.104	0.151	0.152	0.184	0.282	0.296
Number of Market-Carrier Pairs	50,659	49,057	49,057			
Number of Markets				7,391	7,081	7,081

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

Table 4: Effect of Common Ownership (MHHI delta) on Airline Prices: IV Regressions: Second Stage.

The pre-period is 2009Q1 (the quarter before the Barclays BGI acquisition by BlackRock was announced). We divide markets into treatment and control groups as follows: (i) we calculate the actual MHHI delta in 2009Q1, (ii) we calculate a counterfactual MHHI delta in 2009Q1 combining the holdings of Barclays and BlackRock, (iii) we calculate the difference between the counterfactual and the actual for each market, (iv) markets in the top tercile of the difference between counterfactual and actual MHHI delta are assigned to the treatment group; markets in the bottom tercile are assigned to the control group. In the discrete treatment specifications, we instrument the MHHI delta with the treatment status interacted with a post-period dummy. In the continuous treatment specifications, we instrument the MHHI delta with the difference between the "counterfactual" MHHI delta generated by combining the holdings of Barclays and BlackRock in 2009Q1 and the actual MHHI delta in 2009Q1, interacted with a post-period dummy. We exclude markets with less than 20 passengers per day on average. We exclude market-carriers with missing observations during the period 2009Q1-2013Q1. We weight by average passengers for the market-carrier over time. We use population and income per capita for 2012Q4 for the 2013Q1 observations. Standard errors are clustered at the market-carrier level. Variable definitions are provided in the appendix.

	Dependent Variable: Log(Average Fare)							
	Discrete Treatment				Continuous Treatment			
Post-period:	2011Q1	2012Q1	2013Q1	2011-2013 Q1	2011Q1	2012Q1	2013Q1	2011-2013 Q1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MHHI delta	-0.136	0.537***	0.522***	0.312***	-0.189	0.499***	0.474***	0.279***
	(0.150)	(0.107)	(0.115)	(0.109)	(0.141)	(0.101)	(0.109)	(0.107)
HHI	0.103	0.383***	0.393***	0.312***	0.0972	0.364***	0.356***	0.299***
	(0.0658)	(0.0561)	(0.0581)	(0.0507)	(0.0620)	(0.0493)	(0.0528)	(0.0465)
Number of Nonstop Carriers	0.0170***	0.00579	0.0144***	0.0113***	0.0170***	0.00691*	0.0108**	0.00977***
	(0.00478)	(0.00488)	(0.00510)	(0.00327)	(0.00391)	(0.00395)	(0.00449)	(0.00285)
Southwest Indicator	-0.117***	-0.151***	-0.147***	-0.110***	-0.114***	-0.141***	-0.124***	-0.0994***
	(0.0330)	(0.0250)	(0.0187)	(0.0132)	(0.0392)	(0.0243)	(0.0160)	(0.0145)
Other LCC Indicator	-0.0714***	-0.0759***	-0.0543***	-0.0614***	-0.0906***	-0.0999***	-0.0533***	-0.0641***
	(0.0273)	(0.0260)	(0.0174)	(0.0127)	(0.0270)	(0.0238)	(0.0159)	(0.0120)
Share of Passengers Traveling Connect, Market-Level	0.243***	0.206***	0.182***	0.207***	0.247***	0.193***	0.188***	0.210***
	(0.0451)	(0.0466)	(0.0437)	(0.0345)	(0.0370)	(0.0369)	(0.0352)	(0.0268)
Share of Passengers Traveling Connect	0.0831**	0.0860***	0.0923***	0.0813***	0.0817***	0.0682***	0.0668***	0.0655***
	(0.0348)	(0.0317)	(0.0290)	(0.0255)	(0.0279)	(0.0252)	(0.0244)	(0.0202)
Population	-0.134*	-0.106**	-0.0172	-0.0739*	-0.223***	-0.152***	-0.0656	-0.127***
	(0.0718)	(0.0516)	(0.0486)	(0.0448)	(0.0716)	(0.0484)	(0.0457)	(0.0426)
Income Per Capita	0.00755*	0.0158***	0.0273***	0.0169***	0.00710*	0.0176***	0.0253***	0.0173***
	(0.00406)	(0.00385)	(0.00415)	(0.00345)	(0.00366)	(0.00347)	(0.00352)	(0.00304)
Percent Institutional Ownership	-0.193**	-0.0761	-0.256***	-0.119**	-0.262***	-0.107	-0.269***	-0.156***
	(0.0877)	(0.0707)	(0.0669)	(0.0494)	(0.0935)	(0.0745)	(0.0614)	(0.0475)
Institutional Ownership Concentration	1.008*	0.833	2.369***	0.776**	1.355**	0.820	2.301***	0.845**
	(0.578)	(0.601)	(0.638)	(0.394)	(0.643)	(0.602)	(0.581)	(0.371)
Top 5 Holdings as Pct. of Total Institutional Holdings	-0.0762	-0.174**	-0.301***	-0.126***	-0.125	-0.162**	-0.298***	-0.129***
	(0.0909)	(0.0694)	(0.0676)	(0.0441)	(0.0846)	(0.0671)	(0.0636)	(0.0425)
(Share DL × Share NW in 2008Q4) × Post	0.233	0.195	0.371	0.274	0.0640	0.300	0.297	0.221
	(0.269)	(0.268)	(0.314)	(0.253)	(0.172)	(0.207)	(0.198)	(0.171)
(Share UA × Share CO in 2010Q2) × Post	0.718***	0.420	1.030***	0.727***	0.812***	0.376	0.947***	0.702***
	(0.210)	(0.283)	(0.238)	(0.200)	(0.206)	(0.261)	(0.231)	(0.184)
Max Share AA × Post	0.0157	0.0474***	0.00577	0.0167	0.0280**	0.0604***	0.0181	0.0264**
	(0.0148)	(0.0169)	(0.0165)	(0.0144)	(0.0136)	(0.0152)	(0.0148)	(0.0128)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	15,498	15,498	15,498	30,996	23,334	23,334	23,334	46,668
R-squared	0.378	0.431	0.419	0.324	0.348	0.417	0.401	0.310
Number of Market-Carrier Pairs	7,749	7,749	7,749	7,749	11,667	11,667	11,667	11,667

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

Table 4: (continued). Effect of Common Ownership (MHHI delta) on Airline Prices: IV Regressions: First Stage.

The pre-period is 2009Q1 (the quarter before the Barclays BGI acquisition by BlackRock was announced). We divide markets into treatment and control groups as follows: (i) we calculate the actual MHHI delta in 2009Q1, (ii) we calculate a counterfactual MHHI delta in 2009Q1 combining the holdings of Barclays and BlackRock, (iii) we calculate the difference between the counterfactual and the actual for each market, (iv) markets in the top tercile of the difference between counterfactual and actual MHHI delta are assigned to the treatment group; markets in the bottom tercile are assigned to the control group. In the discrete treatment specifications, we instrument the MHHI delta with the treatment status interacted with a post-period dummy. In the continuous treatment specifications, we instrument the MHHI delta with the difference between the "counterfactual" MHHI delta generated by combining the holdings of Barclays and BlackRock in 2009Q1 and the actual MHHI delta in 2009Q1, interacted with a post-period dummy. We exclude markets with less than 20 passengers per day on average. We exclude market-carriers with missing observations during the period 2009Q1-2013Q1. We weight by average passengers for the market-carrier over time. We use population and income per capita for 2012Q4 for the 2013Q1 observations. Standard errors are clustered at the market-carrier level. Variable definitions are provided in the appendix.

	Dependent Variable: MHHI delta							
	Discrete Treatment				Continuous Treatment			
Post-period:	2011Q1	2012Q1	2013Q1	2011-2013 Q1	2011Q1	2012Q1	2013Q1	2011-2013 Q1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat × Post	0.0556***	0.0857***	0.0876***	0.0719***				
	(0.00342)	(0.00349)	(0.00370)	(0.00320)				
Implied Change in MHHI delta × Post					3.940***	5.970***	5.947***	4.902***
					(0.204)	(0.209)	(0.215)	(0.192)
HHI	-0.356***	-0.392***	-0.414***	-0.377***	-0.362***	-0.385***	-0.399***	-0.371***
	(0.0238)	(0.0174)	(0.0165)	(0.0122)	(0.0177)	(0.0125)	(0.0117)	(0.00856)
Number of Nonstop Carriers	0.00748***	0.00131	0.00157	0.00187*	0.00606***	0.00364**	0.00498***	0.00325***
	(0.00153)	(0.00181)	(0.00170)	(0.00108)	(0.00134)	(0.00142)	(0.00122)	(0.000890)
Southwest Indicator	0.0295***	0.0211***	0.00389	0.0153***	0.0189***	0.0124**	0.00477	0.0116***
	(0.00776)	(0.00570)	(0.00591)	(0.00376)	(0.00727)	(0.00494)	(0.00471)	(0.00325)
Other LCC Indicator	-0.0463***	-0.0472***	-0.0519***	-0.0479***	-0.0529***	-0.0494***	-0.0535***	-0.0497***
	(0.0112)	(0.00933)	(0.00669)	(0.00468)	(0.00804)	(0.00804)	(0.00572)	(0.00394)
Share of Passengers Traveling Connect, Market-Level	0.0567***	0.0782***	0.0705***	0.0761***	0.0401***	0.0625***	0.0609***	0.0641***
	(0.0146)	(0.0134)	(0.0126)	(0.00877)	(0.0112)	(0.0107)	(0.00963)	(0.00674)
Share of Passengers Traveling Connect	-0.0184***	-0.0319***	-0.0286***	-0.0267***	-0.0143**	-0.0272***	-0.0216***	-0.0217***
	(0.00648)	(0.00588)	(0.00740)	(0.00489)	(0.00565)	(0.00501)	(0.00602)	(0.00406)
Population	-0.0873***	-0.0355**	-0.0474**	-0.0395**	-0.184***	-0.0805***	-0.0924***	-0.0831***
	(0.0238)	(0.0167)	(0.0190)	(0.0169)	(0.0244)	(0.0138)	(0.0146)	(0.0135)
Income Per Capita	-0.00100	-0.00227*	-0.00259*	-0.00429***	0.000641	0.00132	0.00104	-0.00200*
	(0.00148)	(0.00129)	(0.00136)	(0.00126)	(0.00145)	(0.00114)	(0.00117)	(0.00109)
Percent Institutional Ownership	-0.261***	-0.147***	-0.121***	-0.0778***	-0.348***	-0.186***	-0.142***	-0.103***
	(0.0260)	(0.0243)	(0.0210)	(0.0131)	(0.0257)	(0.0216)	(0.0172)	(0.0114)
Institutional Ownership Concentration	1.433***	0.538***	0.940***	0.312***	2.153***	0.884***	1.046***	0.460***
	(0.168)	(0.205)	(0.213)	(0.108)	(0.184)	(0.188)	(0.185)	(0.103)
Top 5 Holdings as Pct. of Total Institutional Holdings	-0.0210	-0.0174	-0.0184	0.0225*	-0.0720***	-0.0335	-0.0275	0.0157
	(0.0293)	(0.0273)	(0.0237)	(0.0133)	(0.0272)	(0.0251)	(0.0210)	(0.0129)
(Share DL × Share NW in 2008Q4) × Post	0.703***	0.702***	0.528***	0.692***	0.364***	0.514***	0.366***	0.455***
	(0.149)	(0.173)	(0.154)	(0.156)	(0.0827)	(0.0872)	(0.0790)	(0.0845)
(Share UA × Share CO in 2010Q2) × Post	0.0866	0.347***	0.338**	0.275**	0.241*	0.457***	0.474***	0.414***
	(0.125)	(0.124)	(0.139)	(0.127)	(0.130)	(0.124)	(0.142)	(0.136)
Max Share AA × Post	0.0258***	0.0225***	0.0291***	0.0301***	0.0260***	0.0114**	0.0189***	0.0218***
	(0.00480)	(0.00512)	(0.00605)	(0.00494)	(0.00488)	(0.00488)	(0.00552)	(0.00484)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	15,498	15,498	15,498	30,996	23,334	23,334	23,334	46,668
R-squared	0.556	0.643	0.713	0.600	0.538	0.656	0.733	0.603
Number of Market-Carrier Pairs	7,749	7,749	7,749	7,749	11,667	11,667	11,667	11,667

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

Table 5: Effect of Common Ownership (MHHI delta) on Airline Prices: OLS Regressions with IV Sample.

The pre-period is 2009Q1 (the quarter before the Barclays BGI acquisition by BlackRock was announced). We exclude markets with less than 20 passengers per day on average. We exclude market-carriers with missing observations during the period 2009Q1-2013Q1. We weight by average passengers for the market-carrier over time. We use population and income per capita for 2012Q4 for the 2013Q1 observations. Standard errors are clustered at the market-carrier level. Variable definitions are provided in the appendix.

	Dependent Variable: Log(Average Fare)			
Post-period:	2011Q1	2012Q1	2013Q1	2011-2013 Q1
	(1)	(2)	(3)	(4)
MHHI delta	0.164***	0.322***	0.229***	0.245***
	(0.0578)	(0.0610)	(0.0582)	(0.0424)
HHI	0.215***	0.306***	0.273***	0.287***
	(0.0471)	(0.0430)	(0.0417)	(0.0308)
Number of Nonstop Carriers	0.0158***	0.00701*	0.0114***	0.00979***
	(0.00389)	(0.00389)	(0.00436)	(0.00283)
Southwest Indicator	-0.122***	-0.137***	-0.117***	-0.0988***
	(0.0382)	(0.0241)	(0.0147)	(0.0142)
Other LCC Indicator	-0.0734***	-0.109***	-0.0663***	-0.0657***
	(0.0265)	(0.0242)	(0.0158)	(0.0115)
Share of Passengers Traveling Connect, Market-Level	0.241***	0.201***	0.200***	0.212***
	(0.0367)	(0.0356)	(0.0335)	(0.0258)
Share of Passengers Traveling Connect	0.0873***	0.0628**	0.0611***	0.0648***
	(0.0277)	(0.0247)	(0.0234)	(0.0198)
Population	-0.160**	-0.164***	-0.0868**	-0.130***
	(0.0641)	(0.0463)	(0.0427)	(0.0404)
Income Per Capita	0.00840**	0.0167***	0.0240***	0.0171***
	(0.00362)	(0.00340)	(0.00343)	(0.00294)
Percent Institutional Ownership	-0.178**	-0.118	-0.277***	-0.157***
	(0.0850)	(0.0732)	(0.0614)	(0.0473)
Institutional Ownership Concentration	0.932	0.762	2.334***	0.841**
	(0.611)	(0.598)	(0.578)	(0.372)
Top 5 Holdings as Pct. of Total Institutional Holdings	-0.100	-0.166**	-0.294***	-0.129***
	(0.0843)	(0.0655)	(0.0634)	(0.0426)
(Share DL × Share NW in 2008Q4) × Post	-0.148	0.457**	0.501***	0.248
	(0.165)	(0.189)	(0.186)	(0.157)
(Share UA × Share CO in 2010Q2) × Post	0.702***	0.472*	1.091***	0.719***
	(0.186)	(0.260)	(0.225)	(0.182)
Max Share AA × Post	0.0172	0.0631***	0.0245*	0.0273**
	(0.0125)	(0.0149)	(0.0140)	(0.0122)
Year FE	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓
Observations	23,334	23,334	23,334	46,668
R-squared	0.359	0.420	0.405	0.310
Number of Market-Carrier Pairs	11,667	11,667	11,667	11,667

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

A Appendix: Variable Definitions

- Average Fare: we calculate the average fare for a carrier in a given market and year-quarter as the sum of the revenue in that market and year-quarter divided by the total passengers in the market and year-quarter.

- HHI: Herfindahl-Hirschman Index. We calculate the index as the sum of the market shares squared at a given route and year-quarter. We exclude international carriers and very small carriers.

- MHHI: modified HHI. We calculate the index using the formula $MHHI = HHI + \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$, where s_j is the market share of carrier j, γ_{ij} is proportional to the voting shares of shareholder i in carrier j, and β_{ij} is the share of carrier j owned by shareholder i.

- MHHI delta: the difference between the MHHI and the HHI, which is a measure of common ownership of airlines and thus-induced incentives to increase prices in a route.

- Number of non-stop carriers: number of carriers on the route and year-quarter for which the operating carrier on the ticket is in fact operating a nonstop flight according to T100. We exclude the same carriers that are excluded in the HHI calculation and carriers with less than 60 departures each way in the quarter.

- Southwest indicator: a dummy variable that is equal to one if Southwest is a nonstop carrier in a given route for a given year-quarter and zero otherwise.

- Other LCC indicator: a dummy variable that is equal to one if an LCC other than Southwest is a nonstop carrier in a given route for a given year-quarter and zero

otherwise (we consider the following LCC carriers: Southwest, Frontier, JetBlue, Virgin, AirTran, Spirit, Allegiant, Sun Country, Independence, ATA Airlines, Skybus, and North American Airlines).

- Population: geometric mean of endpoint populations (in millions).
- Income per capita: geometric mean of endpoint incomes per capita (in thousands, 2008 dollars).
- Share of passengers traveling connect, market-level: fraction of passengers in a given route that use connecting flights.
- Share of passengers traveling connect: fraction of passengers of a given carrier in a given route that use connecting flights.
- Percent institutional ownership: fraction of shares held by institutional investors according to the Thomson 13F database.
- Institutional ownership concentration: Herfindahl index of institutional ownership, defined as the sum of the shares squared across institutional owners for a given firm in a period of time, according to the Thomson 13F database.
- Top 5 institutional holdings as percentage of all institutional holdings: holdings of the top 5 institutional shareholders in a given firm as a percentage of all institutional holdings, according to the Thomson 13F database.

B Appendix: Robustness Checks

Table 6: Effect of Common Ownership (MHHI delta) on Airline Prices: Panel Regressions Excluding Bankruptcy Periods.

Data is for the period 2001Q4-2002Q2 and 2007Q2-2011Q3. We exclude routes with less than 20 passengers per day on average. For the market-carrier level regressions we weight by average passengers for the market-carrier over time and cluster standard errors at the market-carrier level. For the market level regressions we weight by average passengers in the market over time and cluster standard errors at the market level. Variable definitions are provided in the appendix.

	Dependent Variable: Log(Average Fare)					
	Base			Market-level		
	(1)	(2)	(3)	(4)	(5)	(6)
MHHI delta	0.223***	0.171***	0.155***	0.322***	0.224***	0.237***
	(0.0236)	(0.0224)	(0.0228)	(0.0326)	(0.0304)	(0.0311)
HHI	0.335***	0.268***	0.261***	0.504***	0.418***	0.388***
	(0.0207)	(0.0201)	(0.0210)	(0.0261)	(0.0251)	(0.0270)
Number of Nonstop Carriers		-0.0140***	-0.0124***		-0.0138***	-0.0115***
		(0.00258)	(0.00258)		(0.00345)	(0.00350)
Southwest Indicator		-0.117***	-0.116***		-0.135***	-0.138***
		(0.0131)	(0.0132)		(0.0198)	(0.0198)
Other LCC Indicator		-0.0413***	-0.0440***		-0.0735***	-0.0745***
		(0.00789)	(0.00784)		(0.0108)	(0.0109)
Share of Passengers Traveling Connect		0.0668***	0.0662***			
		(0.0130)	(0.0130)			
Share of Passengers Traveling Connect, Market-Level		0.115***	0.115***		0.192***	0.173***
		(0.0163)	(0.0164)		(0.0184)	(0.0182)
Population		-0.0681**	-0.0791***		-0.00302	-0.0364
		(0.0303)	(0.0300)		(0.0326)	(0.0325)
Income Per Capita		0.00350*	0.00373*		0.00494*	0.00643**
		(0.00209)	(0.00208)		(0.00253)	(0.00252)
Percent Institutional Ownership			-0.00403			-0.163***
			(0.0113)			(0.0233)
Institutional Ownership Concentration			-0.0129			0.221***
			(0.0185)			(0.0305)
Top 5 Holdings as Pct. of Total Institutional Holdings			0.107***			0.237***
			(0.0147)			(0.0239)
Year-Quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓			
Market FE				✓	✓	✓
Observations	537,406	525,232	525,232	111,917	108,846	108,846
R-squared	0.130	0.170	0.174	0.235	0.313	0.332
Number of Market-Carrier Pairs	45,055	43,786	43,786			
Number of Markets				6,863	6,609	6,609

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

Table 7: Effect of Common Ownership (MHHI delta) on Airline Prices: Panel Regressions with Distance-Year FE Interactions.

Data is for the period 2001Q1-2013Q1. We exclude routes with less than 20 passengers per day on average. For the market-carrier level regressions we weight by average passengers for the market-carrier over time and cluster standard errors at the market-carrier level. For the market level regressions we weight by average passengers in the market over time and cluster standard errors at the market level. Variable definitions are provided in the appendix.

	Dependent Variable: Log(Average Fare)					
	Base			Market-level		
	(1)	(2)	(3)	(4)	(5)	(6)
MHHI delta	0.124***	0.128***	0.128***	0.206***	0.219***	0.216***
	(0.0186)	(0.0180)	(0.0168)	(0.0248)	(0.0245)	(0.0235)
HHI	0.235***	0.240***	0.239***	0.377***	0.382***	0.379***
	(0.0163)	(0.0165)	(0.0161)	(0.0213)	(0.0212)	(0.0213)
Number of Nonstop Carriers	-0.00841***	-0.00816***	-0.00758***	-0.00626**	-0.00570**	-0.00482**
	(0.00194)	(0.00190)	(0.00178)	(0.00272)	(0.00260)	(0.00244)
Southwest Indicator	-0.112***	-0.111***	-0.109***	-0.135***	-0.138***	-0.134***
	(0.00949)	(0.00974)	(0.00982)	(0.0155)	(0.0157)	(0.0156)
Other LCC Indicator	-0.0543***	-0.0558***	-0.0569***	-0.0936***	-0.0947***	-0.0961***
	(0.00645)	(0.00634)	(0.00613)	(0.00821)	(0.00817)	(0.00802)
Share of Passengers Traveling Connect, Market-Level	0.154***	0.144***	0.130***	0.216***	0.224***	0.202***
	(0.0133)	(0.0132)	(0.0132)	(0.0149)	(0.0145)	(0.0143)
Share of Passengers Traveling Connect	0.0669***	0.117***	0.0997***			
	(0.0106)	(0.0111)	(0.0111)			
Population	-0.0296	-0.0266	-0.0231	-0.0191	-0.0147	-0.0137
	(0.0262)	(0.0246)	(0.0208)	(0.0283)	(0.0271)	(0.0236)
Income Per Capita	0.00459***	0.00544***	0.00458***	0.00534***	0.00598***	0.00545***
	(0.00175)	(0.00169)	(0.00155)	(0.00201)	(0.00196)	(0.00183)
Percent Institutional Ownership	-0.0186**	-0.0276***	-0.0244***	-0.156***	-0.159***	-0.156***
	(0.00723)	(0.00720)	(0.00708)	(0.0148)	(0.0149)	(0.0154)
Institutional Ownership Concentration	0.0861***	0.107***	0.0927***	0.335***	0.357***	0.333***
	(0.0189)	(0.0183)	(0.0178)	(0.0319)	(0.0322)	(0.0318)
Top 5 Holdings as Pct. of Total Institutional Holdings	0.0308***	0.0224***	0.0240***	0.0735***	0.0598***	0.0658***
	(0.00904)	(0.00861)	(0.00820)	(0.0183)	(0.0176)	(0.0161)
Year-Quarter FE	✓	✓	✓	✓	✓	✓
Year FE × Distance		✓			✓	
Year FE × Distance Group FE			✓			✓
Market-Carrier FE	✓	✓	✓			
Market FE				✓	✓	✓
Observations	1,089,818	1,089,818	1,089,818	222,360	222,360	222,360
R-squared	0.151	0.177	0.191	0.295	0.308	0.332
Number of Market-Carrier Pairs	49,057	49,057	49,057			
Number of Markets				7,081	7,081	7,081

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