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ANTI-COMPETITIVE EFFECTS OF COMMON OWNERSHIP

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Anti-Competitive Effects Of Common Ownership

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Abstract

Many natural competitors are jointly held by a small set of large institutional investors. In the US airline industry, taking common ownership into account implies increases in market concentration that are ten times larger than what is "presumed likely to enhance market power" by antitrust authorities. We find a robust correlation between within-route changes in common ownership concentration and route-level changes in ticket prices, also when we only use variation in ownership due to the combination of two large investors. We conclude that a hidden social cost – reduced product market competition – accompanies the private benefits of diversification and good governance.

JEL Classification: L41, L10, G34

Keywords: Competition, Ownership, Diversification, Pricing, Antitrust, Governance, Product Market[1,2]

[1]The views expressed herein are the views and opinions of the authors and do not reflect or represent the views of other consultants or experts who are affiliated with Charles River Associates, nor do they reflect the views and opinions of Charles River Associates or any of the organizations with which the authors are affiliated.

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1 Introduction

A long theoretical literature in industrial organization predicts that partial common ownership of natural competitors by the same investors can reduce firms' incentives to compete: the benefits of competing aggressively to one firm – e.g. gains in market share – come at the expense of firms that are part of the same investors' portfolio, and reduce total portfolio value. Theory thus predicts that common ownership implies reduced incentives to compete, pushes product markets toward monopolistic outcomes, and implies a deadweight loss for the economy and particularly adverse consequences for consumers.

By contrast, the empirical literature has thus-far largely assumed that common ownership interests by financial institutions don't matter for firms' objectives and product market outcomes. The question whether this assumption is warranted has first-order implications for many areas of economics, such as finance, industrial organization, macroeconomics, as well as antitrust policy. This paper aims to shed light on this question by studying the effect of common ownership on product market outcomes in the U.S. airline industry. Specifically, we ask: first, how large are current levels of common ownership, and what are the implications for market concentration measures? Second, do present-day common ownership levels adversely affect product market competition?

To get a sense of the scope of the first question, note that highly diversified mutual

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fund families and other institutional investors now hold a high (70%-80%, ICI, 2015) and increasing share of US publicly traded firms. Because several asset management companies are also extremely large, the same fund family is often the single largest shareholder of several firms in the same industry, with similarly diversified investors following suit. Table 1 provides examples.[3] The potential scale of the resulting antitrust problem spans across all industries, geographies, and economies with tradable equity securities.

The second question presents a formidable identification challenge. Correlations of common ownership and price-cost margins across firms or industries do not necessarily have a causal interpretation, among others because of potentially omitted controls and reverse causality concerns. To take a step towards addressing these challenges, we focus on the US domestic airline industry as a laboratory. This industry has the advantages that high-quality route-level price and quantity data is publicly available, and that each route can be considered as a separate market. These features allow us to relate common ownership and prices within the same firm, time, and industry, thus reducing the amount of confounding variation. Further, we isolate variation in airline ownership caused by a consolidation event in the asset management to respond to potential concerns related to the endogeneity of airline ownership. To alleviate concerns about model misspecification and about the endogeneity of market shares for which we lack an exogenous source of variation, we propose a variety of placebo tests.

We first calculate measures of market concentration that take into account the network of cash flow and control rights that constitute the airlines' shareholders' economic interests, in addition to competitors' market shares. We find that the anti-competitive incentives implied by common ownership concentration alone – which come on top of those implied by the traditional HHI measure of market concentration and are measured on the same scale –

[3]BlackRock was the single largest shareholder of one fifth of all American publicly trade firms as per *The Economist*, December 7, 2013; Davis (2013); Craig (2013). Our analysis indicates that with now more than $5 trn assets under management, BlackRock is also the largest shareholder of 33 of the FTSE 100 companies (as well as among the top-5 shareholders of 89 of them), the largest shareholder of one-third of the DAX-30 companies; Vanguard, with more than $4 trn assets under management, is almost as large. Fichtner, Heemskerk, and Garcia-Bernardo (2016) calculate that the combined holdings of BlackRock, Vanguard, and State Street make them the largest investor of 88% of all firms in the S&P 500. See Roe (1990); Elhauge (2015) for a discussion of the legal constraints of such ownership structures. An obvious problem would exist if one beneficial owner controlled more than 50% of the voting securities of all firms in the industry. The interesting empirical question is whether N investors that each hold more than 50/N% of votes in all firms – or similar structures – can have similar effects.

are more than ten times larger than what the FTC/DOJ 2010 horizontal merger guidelines presume "to be likely to enhance market power." They are also ten times larger than the HHI-threshold beyond which the burden of proof shifts from the regulator to the involved private parties to show that the implied concentration is not likely to enhance market power. The magnitude of common ownership concentration furthermore dwarfs the time-series variation in HHI. These magnitudes suggest that it is reasonable to expect an effect of common ownership on product prices.

Next, we test whether these anti-competitive incentives do indeed translate into measurable effects on product market competition. Specifically, we examine whether changes in common ownership concentration over time in a given route are associated with changes in ticket prices in the same route. For example, theory predicts that the entrance of an independent player (a firm not owned by the same set of investors who own the incumbent airlines) makes competition more aggressive. By contrast, competition should soften in a route when the owners of incumbent airlines acquire significant ownership and control rights in a thus-far independent carrier serving the same route.

Using fixed-effect panel regressions, we find that ticket prices are approximately 3-7% higher on the average US airline route than would be the case under separate ownership. This effect of common ownership alone is similar in magnitude and comes on top of the effect of the traditional HHI measure of market concentration as well as other commonly used controls. The magnitude is economically significant; the industry's average net profit margin in 2015 was 4% (IATA, 2015). Fixed effects difference out many (but of course not all) alternative interpretations at the firm-, route-, firm-route, or firm-time level, such as confounding effects of fuel or oil price changes. We also find that changes in passenger volume are negatively related to changes in common ownership, indicating that the price effects are not driven by increased demand that institutional shareholders correctly foresee (a reverse-causality argument): if increases in common ownership were caused by increased demand, changes in common ownership should be correlated with higher, not lower quantity.

We then provide a large number of placebo and robustness tests to examine the empirical validity of a large number of concerns regarding functional form, market definition, confounding mergers and bankruptcies, reverse causality, the assumption that control is proportional in the fraction of votes held, and the model of competition. Some of these tests may have direct policy implications. For example, we use a difference-in-differences identification strategy based on BlackRock's acquisition of Barclays Global Investors (BGI) in 2009. This identification strategy uses only variation in common ownership across routes that is implied by the hypothetical combination of the two parties' portfolios as of the quarter before the announcement of the acquisition. Since airline stocks constituted only a small fraction of the merging parties' portfolios, it is unlikely that this variation is driven by expected changes in US airline ticket prices. While estimated using much less variation than the panel regressions, the estimates from this strategy are arguably less affected by endogeneity of ownership and market shares. They indicate that product prices may be 10-12% higher due to common ownership. Multiplying these estimates with the average route-level increase in common ownership due to the consolidation event indicates that the acquisition itself increased average ticket prices by about half a percent.

We then provide additional tests that help shed light on the likely corporate governance mechanisms that implement these incentives; at the same time, these tests help alleviate further endogeneity and misspecification concerns. For example, we find that the results are driven by the top-ranked shareholders at each firm, and by long-term shareholders. The fact that no significant effects obtain when we assume control by shareholders that cannot reasonably expected to have control (such as very small and short-term shareholders) is inconsistent with the hypothesis that the endogeneity of market shares drives the main results. We also document significant effects from both firm-level and market-level variation in common ownership over time, and find that the effects are stronger for larger markets and for more concentrated markets. These findings are consistent with a model of rational attention allocation by investors and airlines to markets where the bottom-line impact of increased prices is greater.

We complement the empirical analysis with a discussion of anecdotal and empirical evidence on shareholder engagement relating to product market strategy using (i) voice, (ii) incentives, and (iii) voting. However, despite the evidence presented, it is important to recognize that common owners of competitors need not explicitly communicate their anticompetitive interests to management for the documented outcomes to materialize. Instead, the *omission* to explicitly demand or incentivize tougher competition between portfolio firms may allow managers to enjoy a "quiet life" (Hicks, 1935; Bertrand and Mullainathan, 2003), and thus cause an equilibrium with reduced competition and sustained high margins. Indeed, we are not aware of systematic evidence supporting the view that large diversified asset managers actively encourage their portfolio firms to compete more aggressively against each other. (Of course, such behavior can hardly be expected, as it would likely violate both the asset managers' and their investors' incentives.) By contrast, concentrated owners such as select hedge fund activists have been shown to successfully push their target firms to compete more aggressively against industry rivals. Competitive concerns thus arise when concentrated owners get crowded out by diversified institutions that also hold large stakes in industry rivals — *even if the institutions driving the common ownership links are entirely "passive"* in terms of corporate governance (other than voting). We discuss policy implications and open questions for research in the conclusions.

2 Related Literature

To our knowledge our paper is the first to empirically identify an effect of common ownership on product prices, and the first to document an effect of consolidation in the asset management industry on portfolio firms' product prices. We thus complement a long but mostly theoretical literature arguing that shareholders with diversified portfolios have an interest in the maximization of joint portfolio profits as opposed to individual firm profits, and thus predicts that diversification can reduce competition in product markets (e.g. Rotemberg, 1984; Farrell, 1985; Gordon, 1990; Admati, Pfleiderer, and Zechner, 1994; Hansen and Lott, 1996; Rubin, 2006; Margotta, 2010; Azar, 2012, 2017). This literature has a rich background. Under imperfect competition, when shareholders hold more than one firm, there can be disagreement among them (see, for example, Hart, 1979), and a theory of shareholder preference aggregation is necessary to obtain an objective function for the firm. To that end, Azar (2012, 2017) develop models of oligopoly firm behavior in which competition for shareholder votes among potential managers leads firms to aggregate and internalize shareholder interests, including holdings in competitors.

Reynolds and Snapp (1986) extend classic oligopoly models to allow firms to hold shares in competitors.[4] Bresnahan and Salop (1986) introduce a modified Herfindahl-Hirschman Index (MHHI) to quantify the competitive effects of horizontal joint ventures. We use O'Brien and

[4]See also Bernheim and Whinston (1985); Flath (1991, 1992); Malueg (1992); Nye (1992); Bolle and Güth (1992); Reitman (1994); Parker and Röller (1997); Clayton and Jorgensen (2005); Gilo, Moshe, and Spiegel (2006); Foros, Kind, and Shaffer (2011); Bebchuk, Kraakman, and Triantis (2000); Nain and Wang (2016).

Salop (2000)'s version of the MHHI for our reduced-form empirical tests.

On the empirical side, the closest paper is Azar (2012), who provides measures of common ownership of U.S. stocks over time and finds a positive effect on profit margins in cross-industry panel regressions, concluding that the full ownership structure of the firms, including institutional shareholders with passive portfolio strategies, should be used in the calculation of modified indices of market concentration. Following this work, He and Huang (2014) use trends across industries of a binary common ownership measure and correlate it with firm-level outcomes such as profitability and market share growth.[5] No study prior to the present one has examined effects of common ownership on product prices.

In terms of both methodology and setting, our analysis mirrors that of Borenstein (1990); Werden, Joskow, and Johnson (1991); Kim and Singal (1993); Evans and Kessides (1994); Borenstein and Rose (1994, 1995); Peters (2006); Goolsbee and Syverson (2008); Brueckner, Lee, and Singer (2013); Luo (2014); Kwoka, Hearle, and Alepin (2016), who study the price effect of airline mergers and other route characteristics on prices. By contrast, we investigate the effects of changes in market concentration due to changes in the ownership structure of the industry, holding constant the known structural determinants of prices.

We also contribute to a literature, reviewed in section 6, on institutional investors' involvement in corporate governance. In particular, it is well known that "activist" investors implement changes in executive compensation, turnover, and other corporate decisions that may affect product markets, see especially Brav, Jiang, Partnoy, and Thomas (2008); Brav, Jiang, and Kim (2011). We note that strategic changes can typically only be implemented with the support of the firms' largest shareholders, which increasingly are institutions traditionally labelled as "passive" investors. Importantly, "having a passive investment strategy has nothing to do with your behaviour as an owner" (Scott, 2014). Our paper thus provides evidence for the notion that "the boundary between long-only money managers and activists

[5] Bolle and Güth (1992) calculate the ultimate ownership of natural competitors in the German gas industry, and propose that firms' price setting behavior reflects their shareholders' interests in competitors; Hansen and Lott (1996) document the extent of common ownership across various competitors by institutional investors; more recently, Davis (2008) points to "a new finance capitalism" due to increasing mutual fund ownership concentration of US firms, but focuses on ownership by families of actively managed funds that constitute "relatively transient owners." None empirically addresses the question whether competition is affected. Networks of common ownership generated by diversified institutional investors are also studied by (see, e.g., Faccio and Lang, 2002; Vitali, Glattfelder, and Battiston, 2011; Davis, 2013) and have been related to shareholder voting and various firm-level outcomes (e.g. by Matvos and Ostrovsky, 2008; Harford, Jenter, and Li, 2011; Fichtner, Heemskerk, and Garcia-Bernardo, 2016).

is starting to blur" (Gelles and de la Merced, 2014).

Lastly, our results contribute an empirical answer to the question "Do firm boundaries matter?" (Mullainathan and Scharfstein, 2001; Atalay, Hortaçsu, and Syverson, 2014). Our results suggest that common ownership links can have the effect of blurring formal firm boundaries.

3 Hypothesis Development

A literature in finance and industrial organization, reviewed above, predicts that shareholder diversification can lead to lessened competition in portfolio firms' product markets. To see why, imagine an industry with two equal-sized firms, A and B. Suppose A undercuts B's price to attract customers from B and thus gain market share. Depending on parameters, firm A may benefit from such a move, as it sells many more products at an only slightly reduced price. Variations of this logic are the basis for many standard models of competition.

However, A's gain in market share comes at the expense of firm B's market share, and average prices in the market are lower. The owner of firm B looses more revenue than the owner of firm A gains – hence, the sum of A's and B's producer rents falls. That means an investor holding equal-sized stakes in both A and B enjoys greater total (i.e. portfolio) profits when the firms set prices or quantities as if they were two divisions of a monopoly, instead of acting like two independent firms. One should thus expect less competition, compared to the standard model, to the extent shareholders are diversified across natural competitors, and to the extent portfolio firms act in their diversified shareholders' interest.

This intuition is captured even by the popular press, e.g. following Berkshire Hathaway's acquisition of major stakes in each one of the nation's largest four airlines. CNBC's Becky Quick asks "You know, Warren, it does occur to me, though, if you're building up such a significant stake in all the major players, is that anything that's, like, monopolistic behavior? Is there any concern to think that you would say something to the airlines to make them make sure that they're not competing [...] quite the same? What would keep somebody from worrying about that?" (Quick, 2016).[6]

[6] We discuss evidence of various types of shareholders making demands to soften competition in section 6. That said, recalling Table 1, it seems reasonable to assume that Wells Fargo's CEO understands that it is not in his largest shareholders' best interest to compete aggressively for market share against Bank of America, even without explicit communication with either shareholders or competitors' managers. After all,

To empirically investigate the question whether diversification across competitors leads to higher product prices, we need a measure that captures to which extent a firm's most powerful owners are also owners of natural competitors, and vice versa. One such measure is the "modified Herfindahl-Hirschman index" (MHHI), originally developed by Bresnahan and Salop (1986); O'Brien and Salop (2000), and used by regulators worldwide to assess competitive risks from holdings of a firm's stock by direct competitors. Regulators usually ignore beneficial ownership by financial investors; by contrast, we calculate MHHIs taking into account all beneficial owners of shares, which in most cases are industry outsiders.

One attractive property of the measure is that it allows to decompose total market concentration (MHHI) in two parts, industry concentration as measured by the Herfindahl-Hirschman Index (HHI), $\sum_j s_j^2$, where s_j is the market share of firm j, and common ownership concentration, called MHHI delta. HHI captures the number and relative size of competitors; MHHI delta captures to which extent these competitors are connected by common ownership and control links. Formally,

$$\underbrace{\sum_j \sum_k s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}}_{MHHI} = \underbrace{\sum_j s_j^2}_{HHI} + \underbrace{\sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}}_{MHHIdelta}, \tag{1}$$

where β_{ij} is the ownership share of firm j accruing to shareholder i, γ_{ij} the control share of firm j exercised by shareholder i, and k indexes firm j's competitors.

Another feature is that MHHIs can be interpreted in the context of a Cournot model of competition, as we explain in appendix A to help inform the interpretation of our empirical results and to clarify potential sources of endogeneity. However, we do not estimate the model, but use MHHI delta as a reduced-form measure of reduced incentives to compete due to common ownership.

The empirical question we address is whether common ownership concentration as mea-

Berkshire Hathaway, Wells Fargo's largest shareholder, famously acquired a multi-billion ownership stake in Bank of America during the financial crisis, and all other top shareholders of the nation's largest banks hold major stakes in all banks. We feel equally assured that not only Bank of America, but also JP Morgan is well-informed about these interests, given regular interactions between JP Morgan's top management and its largest shareholders on corporate governance topics (e.g. Foley and McLannahan, 2016), and given that Berkshire Hathaway's Co-CIO sits on JP Morgan's board of directors (Buhayar, 2016). We find it equally likely that the top management teams of the United States' largest airlines also learned about major shifts in the ownership structure of the industry even without being personally informed by Warren Buffett.

sured by MHHI delta has explanatory power for airline ticket prices after controlling for market concentration as traditionally measured (by the HHI) and other known determinants of prices. If MHHI delta does not capture an important element of shareholder incentives, or if governance or informational frictions entirely prevent the implementation of shareholders' anticompetitive incentives, empirical tests should support the null hypothesis:

H0: Common ownership concentration, as measured by MHHI delta, has no effect on ticket prices.

If, on the other hand, economic incentives as captured by the measure matter for economic outcomes at least to some extent, the alternative hypothesis should find support:

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

We investigate these hypotheses using various alternative methods of calculating MHHI delta, some of which relax the "proportional control" assumption, as well as measures that can be interpreted in the context of a Bertrand model of competition.

4 Data

4.1 Data on Ticket Prices and Market Shares

We construct fares and passenger 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 for the period 2001Q1-2014Q4. Following the literature, the markets we consider in our baseline specifications are origin-destination airport pairs in the United States, regardless of direction, but we also offer results based on city pairs. To construct prices and the number of passengers at the carrier level, we assign a ticket to the marketing carrier (rather than the operating carrier), and we exclude tickets with multiple ticketing carriers from the analysis.[7] We limit our analysis to markets

[7]We thus abstract away from frictions associated with imperfect vertical integration (Forbes and Lederman, 2009, 2010). Relatedly, alliances other than direct affiliations, are typically between domestic and

with an average of at least 20 passengers a day. 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, as described in detail in the Data Appendix, along with a description of the key variables. We retain over 1 million observations at the carrier-market-quarter level.

Table 2 shows summary statistics for our sample, both at the carrier-market and at the market level. The average 2008-CPI-adjusted fare per passenger across markets is \$219. Average quarterly passengers are about 3,930 per carrier and market and about 18,428 per market. The HHIs are calculated based on passenger shares of ticketing carriers, and average about 5,300 across markets and over time. On average, around two thirds of passengers in a given market use connecting flights. On average, our sample markets contain 0.73 nonstop carriers. Southwest is competing nonstop in 9% of the markets, and other LCCs are competing nonstop in 8% of the markets. For each market in our sample, we use data from the Bureau of Economic Analysis to calculate the geometric mean across the metro areas at the endpoints of population and income per capita, following the airline literature (see, e.g., Brueckner, Lee, and Singer (2013)). The average "market population" is 2.3 million and the average "market income" is about \$42,000. Untabulated, the average fraction of institutional ownership is 72%; the median is 81%.

4.2 Data on Airline Ownership

To construct the common ownership network for each market-year-quarter, we start with institutional holdings from the Thomson-Reuters Spectrum dataset on 13F filings. This data set includes all US holdings of publicly traded firms by institutional investors managing more than \$100 million as well as information on the number of shares that are voting shares.[8] Holdings are not observed during bankruptcy periods. During the bankruptcies of American Airlines, Delta Airlines, Northwest Airlines, United Airlines, and US Airways, we repeat

foreign carriers but not between domestic carriers (Brueckner and Whalen, 2000). In rare exceptions, such as the codeshare agreement between US Airways and United Airlines, we ensure in an untabulated robustness check that combining the market shares of both companies as if they were a single entity does not significantly affect the results.

[8]The Thomson-Reuters dataset is well-known to be incomplete and feature various other inaccuracies. To improve its accuracy, we combine holdings from separate filings by the same asset manager, and add missing filings for BlackRock in the periods 2010 and 2013-2015, Barclays in the period 2003Q4, Northern Trust in the period 2014Q1, BNY Mellon in the period 2013Q3, and JPMorgan in the periods 2003Q4, 2008Q3, 2013Q3-Q4, which we obtain from the SEC website.

the last observed value for percentage of shares owned; we offer detailed robustness and placebo results using bankruptcy events. We complement the institutional ownership data with hand-collected non-institutional ownership from SEC Proxy statements, available from the SEC website, if such owners hold at least 5% of outstanding shares in any company in our sample.

To illustrate the extent of common ownership in the present-day US airline industry, we provide the top-10 shareholders and their ownership percentage as of the fourth quarter of 2016 for a sample of airlines in Table 1. Note that American Airlines' top-seven shareholders (who jointly control 49.55% of the stock) are also among the top-10 investors of Southwest Airlines and various other competitors. In turn, each of Southwest's largest six shareholders is also among the top-10 shareholders of American and Delta, and five of them are among the top-10 holders of United as well. By contrast, an individual owning 20.30% is Allegiant Air's largest shareholder; he does not appear among the largest holders of any of the other airlines. We use changes in ownership across airline combinations and over time as a source of identifying variation.

4.3 Quantifying Economic Incentives Using the MHHI

The above examples give an intuitive sense of the level to which industry competitors are commonly owned, but do not quantify common ownership concentration. To do so, we calculate the control share for shareholder i in firm j, γ_{ij}, as the percentage of the sole and shared voting shares of firm j held by shareholder i. Similarly, we calculate the ownership share of investor i in firm j, β_{ij}, as the percentage of all shares (voting and non-voting) of firm j held by shareholder i. We disregard shareholdings with voting and non-voting shares of less than 0.5%. Doing so amounts to assuming that institutions with less than 0.5% have no weight in the objective function of the firm; weconsider variations later. As for the definition of "shareholder," we aggregate holdings at the fund family level to match the institutional feature of voting and governance at the family level, as well as the fund families' incentives, which – consistent with the incentives of their investors – are primarily determined by the value of their total assets under management. (The family's incentives must not be confused with the incentives of an individual fund manager within the family, which are often tied to outperforming a benchmark or tracking an index).[9]

We calculate the MHHI delta (the density of the ownership network) for each route for each quarter between 2001Q1 and 2014Q4. Figure 1 shows the average MHHI and average HHI across routes over time for that period; the difference (MHHI delta) is the part of market concentration that is generated by common ownership. The average MHHI delta was around 1,400 at the beginning of the period, declined to around 1,000 in 2006-2007 when concentrated owners acquired relatively large stakes in the industry amid its low profitability, and then increased to about 2,500 in 2014. Weighting by average passengers in the market over time, the average MHHI delta in 2014 is 2,044. The stark increase in MHHI delta in 2009 coincides with BlackRock's acquisition of Barclays Global Investors that we will later use in one of our identification strategies.

To put these numbers in perspective, the DOJ/FTC 2010 Horizontal Merger Guidelines state that, in highly concentrated markets (i.e., markets with an HHI greater than 2,500), mergers involving changes in the HHI of more than 200 points are "presumed likely to enhance market power." Thus, the average MHHI delta in the airline industry generated by common ownership in 2014Q4 implies increases in concentration that are more than 10 times higher than the threshold that would likely generate antitrust concerns according to the guidelines, if consequentially applied to MHHI. This threshold also marks the point beyond which, if two parties intended to merge, the burden of proof that the merger does not lead to enhanced market power shifts to the merging parties (as opposed to the regulator). Hence, if the regulator were to consequentially apply this logic to changes of market concentration that are due to common ownership, asset managers would have to prove that the common ownership links that their holdings or acquisitions create do not affect market prices.

[9] One may hence wonder why fund managers rescind their votes to an office that may vote the shares different from their own fund's interest. There are two responses. First, it is well known that fund families cross-subsidize across funds in the interest of their families (Gaspar, Massa, and Matos, 2006). Second, coordinating corporate governance activities at the family level can be consistent with fulfilling the fund manager's fiduciary duty toward the individual investors: the equilibrium outcome can benefit all investors compared to the alternative of disaggregated voting, even if each individual owner would choose a slightly different policy. That can be true both for cost degression and strategic reasons. Individual investors appear content to give up voting rights to the fund manager for similar reasons. The strategic interpretation would be that the asset manager serves as a coordinating device, similar to the role of some voting trusts a century ago. Although some evidence exists of coordination of governance activities across fund families, we do not empirically entertain the possibility of block holders forming coalitions as suggested by Zwiebel (1995) because we have no hard data. Interviews with proxy managers indicate that antitrust concerns prevent them from discussing proxy voting with other investors at a high frequency.

Figure 1 shows histograms of the distribution of MHHI deltas across routes in 2001Q1 and in 2014Q4. Across the entire sample, about 5% of routes have an MHHI delta of close to zero – that is, there is no common ownership. That is the case either if only one carrier serves the route, or if the route is served by multiple carriers that do not share common owners. For example, JetBlue was not publicly traded in 2001, went public in 2002, and became owned by similar investors as legacy carriers thereafter. Thus, some routes served by JetBlue may be part of the zero-MHHI delta group in 2001, but move to positive-MHHI delta groups after the IPO. In the 2014Q4 distribution, the 10th percentile is at 109 HHI points, the 25th at 1,421, the median at 2,684, the 75th at 3,642, and the 90th percentile is at 4,184 HHI points. On average common ownership adds about as much concentration as going from four roughly equal-sized carriers to two equal-sized carriers would add. The correlation between MHHI delta and HHI is -0.69. The correlation between the MHHI and the HHI is 0.87.

In sum, the incentives for anti-competitive behavior implied by current levels of common ownership, as measured by the MHHI delta, are an order of magnitude larger than the implications for market power recognized by conventional measures that are measured on the same scale. Whether firms implement these incentives is the empirical question we address in the following sections.

5 Empirical Methodology and Results

5.1 Panel Regressions of Product Prices on Common Ownership

Figure C.1 plots the average airfare against the average MHHI delta for each market in our sample, where the average is taken across all quarters in our sample period. A linear fit indicates a positive raw correlation between airfares and MHHI delta across markets. Of course, we do not infer a causal effect from this raw correlation. Many factors could impact the level of airfares across markets that may also be correlated with common ownership in a given market. In our baseline result we address various of such omitted variable concerns with explicit controls and a large number of fixed effects.

5.1.1 Panel Regression Methodology

In our main specification, we regress the logarithm of average price for carrier j in route r at time t on the MHHI delta, the HHI, additional controls, time fixed effects, and market-carrier fixed effects:

$$\log\left(p_{rjt}\right) = \beta \cdot \text{MHHI delta}_{rt} + \gamma \cdot HHI_{rt} + \theta \cdot X_{rjt} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}, \tag{2}$$

where p_{rjt} is the average price for carrier j in route r at time t, MHHI delta_{rt} is the MHHI delta in route r at time t (it is the difference between MHHI and HHI – it is *not* the time variation in MHHI), X_{rjt} is a vector of controls, α_t are time fixed effects (at the quarterly frequency), and ν_{rj} are market-times-carrier fixed effects. Following Goolsbee and Syverson (2008), we weight the market-carrier-level regressions by average passengers for the market and carrier over time. We cluster standard errors two-ways by market-carrier and by year-quarter. Additionally, we run regressions aggregated at the market level:

$$\log\left(p_{rt}\right) = \beta \cdot \text{MHHI delta}_{rt} + \gamma \cdot HHI_{rt} + \theta \cdot X_{rt} + \alpha_t + \nu_r + \varepsilon_{rt}, \tag{3}$$

where p_{it} is the average price in route i at time t. (We entertain a large number of alternative specifications later.)

In the market-level regressions we weight by average passengers for the market and cluster standard errors two-ways, by market and year-quarter.

As controls, we include the log of distance interacted with year-quarter fixed effects to control for the price effect of changes in oil or fuel prices that may differentially affect routes of different length in ways that could be correlated with common ownership for some reason. We also include various market characteristics that the HHI fails to capture: the 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, the log of the geometric average of the population in the two endpoints of a route, the log of 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).

When interpreting the MHHI delta coefficient (β), one should keep mind that market shares (which enter both MHHI delta and HHI calculations) are potentially endogenous in ways that are likely to negatively bias the MHHI delta coefficient. An investor with holdings only in one airline should increase her stakes if she correctly (and before the rest of the market) anticipates an increase in profitability of the firm. Such purchases decrease MHHI delta, thus leading to a negative relation between MHHI delta and future price-cost margins. If this theory is correct, an instrumented version of the above regression should produce higher estimates of β, which is a hypothesis we later test and find support for. The bias could also go in the other direction.[10] A comparison of estimates across panel and instrumented regressions will shed more light on the likely direction of any bias. We also show in several placebo tests that variation in MHHI delta driven by changes in ownership by shareholders with little effective control does not correlate with price changes. This finding is consistent with the hypothesis that the endogeneity of market shares does not drive our results.

5.1.2 Panel Regression Results

Results from our basic specifications (2) are reported in Table 3. We find a large and significant positive effect of MHHI delta on average fares across all specifications. The coefficient of 0.192 in the first specification with only time- and market-carrier fixed effects implies that an increase in the MHHI delta from 0 to 2,000 (approximately the weighted average level of MHHI delta in 2014Q4) is associated with an increase in average fares of 4%. Similarly, going from the 25th to the 75th percentile increases prices by 4.3%. Going from the 10th to the 90th percentile of routes by MHHI delta indicates an 8.2% increase in fares. Regressing prices on MHHI, rather than MHHI delta and HHI separately, yields a coefficient around 0.22 (untabulated).

In specification (2), we account for the differential effect that changes in jet-fuel prices may have on operating costs in routes of different lengths by controlling for the log of distance interacted with year-quarter fixed effects. Doing so leads to slightly higher coefficients on both the HHI and the MHHI delta. In specification (3), we add controls for market characteristics. The coefficients of both the HHI and the MHHI delta remain positive and statistically and economically significant, albeit slightly attenuated relative to the first specification. The

[10] Somewhat implausibly, this would be the case if passive investors' portfolios anticipated demand shifts in particular airlines routes more so than active investors did, and bought shares in multiple airlines flying these routes, thus leading to an endogenously positive relation between MHHI delta and ticket prices.

coefficients on the control variables have the expected signs: a larger number of nonstop competitors, Southwest's and other LCC's nonstop presence are all associated with lower fares.

Specifications (4) to (6) are analogous to specifications (1) to (3), but aggregated at the market level instead of at the market-carrier level. We find qualitatively similar results, but the coefficients of both the MHHI delta and the HHI are higher. One possible reason is that specifications (4) to (6) do 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 would not be controlled for. Another possibility is that in the market-carrier-level regressions the large number of fixed effects exacerbates measurement error and therefore lead to more severe attenuation bias, while this attenuation bias is less severe in the market-level regressions, where the number of fixed effects is smaller.

5.1.3 Robustness of the Baseline Analysis

Given that the airline industry went through significant changes over time, we examine as a first basic robustness test whether the effect of MHHI delta is similar over time by interacting both the MHHI delta and the HHI with year dummies. Figure C.2 shows the respective coefficients for a specification at the market level with controls. The effect of MHHI delta on fares is positive and statistically significant in most years and similar in magnitude in almost all years, but the effect of MHHI delta is slightly more volatile. The MHHI delta coefficient is insignificant in 2006 and 2007, possibly because both Delta Air Lines and Northwest were in bankruptcy during this time. Bankruptcies may confound the effect because shareholders have no de jure control rights during such times, and this feature is not captured in our computation of MHHI delta.

To more directly investigate the impact of bankruptcies on our estimates, in Table 4, specification (1), we exclude quarters in which one of the major airlines was in bankruptcy from the sample, retaining only the periods 2001Q1-2002Q2, 2007Q2-2011Q3, and 2014Q1-2014Q4. The estimates are similar to the main specification. Table C.3 shows that if we sample only market-carriers in bankruptcy, there is no effect of MHHI delta (but also no effect of HHI, maybe because of the reduced sample size). The following specifications show that the MHHI delta effect is similar to the baseline in markets not affected by bankruptcies, and significant both in bankruptcy markets and non-bankruptcy markets (though the effect of both MHHI delta and HHI is higher in the latter). The bottom line is that the effect is generally weaker in markets and at times affected by bankruptcies, consistent with shareholders not being in control during such times. We conclude that the baseline results are not driven by an unusual sub-period within the sample in general or by bankruptcies in particular.

We also check for robustness to adding institutional ownership and institutional ownership concentration controls. Following Hartzell and Starks (2003), we calculate the share of institutional ownership, institutional ownership concentration (measured as the HHI of the institutional ownership shares), and the fraction of total institutional ownership that is held by the top five institutional owners in the firm. For the market-level regressions, we calculate a passenger-weighted average of the institutional ownership variables. The results are similar, as shown in Table 4, specification (2).The table also shows robustness to various other concerns. For example, city pairs may constitute a better market definition than airport pairs. Table 4, specification (3) shows that the results are similar, and in fact somewhat stronger. Also, the functional form assumed by equation (2) is unlikely to drive the results: controlling for a tenth-order polynomial in HHI does not significantly change the MHHI delta coefficient (spec. (4)).

5.1.4 Limitations of the Baseline Analysis

An attractive feature of the analysis so far is that a large number of potentially omitted variables is differenced out via fixed effects. For example, because we employ carrier-route-fixed effects, market power on specific routes exerted through frequent-flyer programs (Lederman, 2007) is differenced out in our regressions. Nevertheless, several other significant limitations remain at this stage, driven by the potential endogeneity of both market shares and ownership, as well as various forms of model misspecification. We first address reverse causality, namely the idea that ownership changes could be driven by price changes, rather than the other way around. Second, we consider variations in how we compute MHHI delta. Most importantly, we relax the proportional control assumption. Doing so, we not only ensure robustness, but also obtain insights into which shareholders drive the results, as well as what are the corporate governance mechanisms that appear to be at play. These variations also yield important placebo tests: when MHHI delta is computed using ownership stakes of shareholders that one cannot reasonably expected to exert control on firm strategy, MHHI delta should have no effect on prices, unless the endogeneity of market shares or other misspecifications drove the result. Third, we entertain alternative specifications that can be more easily interpreted in the context of a Bertrand model of competition, and we show that controlling for multi-market contact does not significantly affect the effect of common ownership concentration.

5.2 Responses to Reverse Causality Concerns

We offer three sets of tests to examine and reject the hypothesis that the baseline results are due to chances in ticket pricing causing changes in ownership, rather than the other way around. We begin with distributed-lag regressions, followed by a difference-in-differences (DiD) and an IV strategy using a large consolidation event in the asset management industry as a quasi-exogenous shock to common ownership concentration, and close with panel regressions of passenger volume as the outcome variable instead of ticket prices.

5.2.1 Panel Regressions with Leads and Lags of MHHI delta and HHI

If common ownership causes higher prices, but higher prices don't cause common ownership, one would expect higher prices to follow increases in common ownership, and not higher common ownership to follow higher prices. To test these hypotheses against each other, we implement dynamic panel regressions that include leads and lags of MHHI deltas. Table 5 shows that the coefficients of lags of MHHI delta are correlated with prices, whereas the coefficients on leads of MHHI delta are not significantly different from zero. The former result reduces the likelihood of reverse causality, and is consistent with the institutional feature that most airlines pre-commit capacity to routes months in advance. The latter (non-)result constitutes a first successful placebo test. Note also that the lagged-MHHI delta coefficient is very similar in magnitude to the baseline estimate. Untabulated regressions with three leads and lags of the MHHI deltas and the HHI indicate that the leads of both MHHI delta and HHI are jointly insignificant, whereas the lags are jointly highly statistically significant.

However, there remains a theoretical possibility that some investors are very well-informed about route-level demand changes several months before the fact, but cannot tell which airline serving the route will benefit more, therefore buy shares of all airlines with high market shares in precisely those routes, and thus drive the association between lagged MHHI delta and current prices. To examine that hypothesis, we would ideally like to re-assign common ownership densities across routes in ways that have no obvious link to future changes in demand or pricing strategies of airlines. An event that took place in the asset management industry in 2009 affords us a setting that comes close to such an ideal experiment.

5.2.2 Using Variation from the BlackRock-BGI Acquisition

Background on BlackRock's Acquisition of Barclays Global Investors

Following the financial crisis that began in 2007, Barclays tried for several months to strengthen its balance sheet. On March 16, 2009, Barclays had received a $4 billion bid by CVC Capital Partners for its iShares family of exchange-traded funds, along with an option to solicit competing offers. BlackRock announced a bid to acquire iShares' parent division Barclays Global Investors (BGI) for $13.5 billion on June 11, 2009 (i.e., in 2009Q2). The bid was successful and the acquisition was formally completed in December 2009.

The history of Barclays' attempt to sell iShares to investors other than BlackRock suggests the divestment decision was not primarily driven by considerations regarding how the iShares portfolio would combine with BlackRock's in terms of potential product market effects. Moreover, US airline stocks of course comprised only a small share of BGI's portfolio. This fact makes it unlikely that airlines were pivotal in BlackRock's decision to acquire BGI, much less route-level variation in expected ticket price changes, thus alleviating reverse causality concerns. More formally, the exclusion restriction is that the cross-sectional distribution across US airlines routes in the implied increase in common ownership from a hypothetical, pre-merger combination of BLK and BGI's equity portfolios is uncorrelated with errors of the ticket price regression, conditional on controls. This assumption could fail for example if we systematically mismeasured economic conditions at departure and destination points in such ways that happen to begin to correlate after the acquisition with the increase in common ownership concentration implied by the BLK-BGI acquisition. While we are not aware of a particular reason to expect such a correlation, such a possibility remains a limitation of our analysis. This is the key argument behind the exclusion restriction for the difference-in-differences strategy that follows.

While airlines made up only a small part of the merging parties' portfolios, both Barclays and BlackRock were among the largest owners in some airlines, but not in others. For example, Barclays was the fifth-largest and BlackRock was the 17th-largest shareholder of Airtran Airways in 2009Q1, but a hypothetically combined BlackRock-BGI entity would have been the second-largest shareholder of the firm in 2009Q1, and correspondingly much more powerful. By contrast, BGI also held a large stake in American Airlines before the merger, but BlackRock did not. As a result, merging BlackRock and BGIs equity portfolios had no effect on American's ownership structure. The variation across portfolio firms in the degree to which the BlackRock-BGI changed their ownership structure translates into variation across airline routes, because different combinations of airlines compete in different routes. The following section quantifies that variation.

Difference-in-Differences Design

We exploit the variation in ownership generated by BlackRock's acquisition of Barclays BGI as follows. We start by calculating the MHHI delta in the quarter before the acquisition was announced, 2009Q1, for each airline market. We then calculate a counterfactual MHHI delta for the same period and market with the only difference that we treat the holdings of BlackRock and Barclays as if they had been held by a single entity already. We call the difference between the latter and former MHHI delta the "implied change in MHHI delta." The null hypothesis, of course, is that the acquisition – as any other ownership change – had no effect on portfolio firms' product market behavior. The alternative hypothesis is that markets more affected by the acquisition – those with a higher implied change in MHHI delta – experience higher price changes compared to less affected markets.

Figure C.3 shows the distribution of the implied change of MHHI delta across routes. Markets in the top tercile are the treatment group, and markets in the bottom tercile are the control group. The mean and median across routes of the implied change is 91 HHI points; the implied change is larger than 100 HHI points in more than 2,000 routes; the largest implied increase is 281 HHI points. These are non-trivial changes in market concentration, for which we can reasonably expect to find increases in market prices. The DOJ/FTC Horizontal Merger Guidelines state that "Mergers resulting in highly concentrated markets [HHI over 2,500] that involve an increase in the HHI of between 100 points and 200 points potentially raise significant competitive concerns and often warrant scrutiny."

We then estimate the following difference-in-differences specification, interacting the treatment dummy and controls with year-quarter fixed effects, for all periods 2006Q2 (12 quarters before announcement) through 2014Q4:

$$\log\left(p_{rjt}\right) = \sum_{k=-n_{pre}}^{n_{post}} \delta_{DiD}^{k} \cdot Treat_{r}^{k} + \sum_{k=-n_{pre}}^{n_{post}} \gamma_{DiD}^{k} \cdot X_{rj}^{k} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}, \tag{4}$$

where $Treat_j^k$ is an interaction of the treatment dummy with year-quarter fixed effects, that is, it is equal to one for treated firms in period k, and zero otherwise. Similarly, X_j^k is an interaction of pre-period control variables with year-quarter fixed effects. We drop the interactions with 2008Q4, so that quarter serves as the base period, with the estimated δ_{DiD}^k coefficients representing the change in the difference between treatment and control markets between 2008Q4 and the given period.

Various potentially confounding events happened around this period, including several mergers, a bankruptcy, and the Great Recession. First, the Delta and Northwest merger was announced in April 2008 and became effective in September 2008. Similarly, the United and Continental merger was announced in May 2010 and became effective in October 2010, Southwest-Airtran was announced in September 2010 and became effective in March 2012, and American-US Airways announced their merger in February 2013, effective November 2013. The mergers potentially directly affected markets that had a sizable share of both merging partners. If these effects were for some reason correlated with the way common ownership concentration increases as a result of the BlackRock-BGI acquisition, the DiD coefficients could be biased. To elicit if this concern is likely to be empirically important, we measure how much a route was affected by each merger by computing the implied increase in HHI in each route in the quarter before the merger for the Delta-Northwest merger, and in 2009Q1 for the others (since these happened after the BGI acquisition, we need to use 2009Q1 instead of the pre-merger quarter to avoid using the post-period in the calculation of the control variables). We add these implied HHI deltas interacted with year-quarter fixed effects as controls. In addition, American Airlines filed for bankruptcy in November 2011. We control for American's share in a market in 2009Q1 interacted with year-quarter fixed effects to account for any direct effect of the event. Lastly, the US economy was emerging from recession around the time of the BGI acquisition. We measure exposure of a route to recession as the change of log per capita income between the start of the Great Recession in 2007Q3 and 2009Q1, and add this measure interacted with year-quarter fixed effects as a control as well.

The results are reported in Figure 2. Whereas the difference between treatment and control fluctuates around zero to some extent during the pre-period, the overall trend before the announcement is flat. The trend changes after the announcement of the acquisition, and the coefficients are significantly positive for most periods after the completion of the acquisition. Thus, the sign of the effect, based on variation in common ownership generated by the BGI acquisition is consistent with our previous results from the panel regressions.

IV Design

We complement the DiD analysis above with an IV strategy to obtain a quantitative estimate of the effect of the MHHI delta on prices from the variation generated by the event study. (The relative benefit of the discrete-treatment specification is that it may mitigate concerns related to measurement error and is easier to understand and graphically illustrate; the benefit of the continuous-treatment version is that it makes use of more variation.) As the pre-period, we use the first quarter before the announcement, 2009Q1. We use 2010Q1, 2011Q1, 2012Q1, 2013Q1, and 2014Q1 as the post-periods (we follow the literature by using the same quarter as the pre-period to rule out effects of seasonality), and then an average for the five quarters 2010Q1-2014Q1. We run specifications with the change in log average fares between the period of interest and 2009Q1as the dependent variable, and the post-period on the change in MHHI delta between 2009Q1 and the post-period as the main explanatory variable, controlling for market and carrier characteristics evaluated in 2009Q1. We include as controls all the variables used in the baseline specification:

$$\Delta_{2009Q1-Post} \log\left(p_{rj}\right) = \delta_{IV} \cdot \Delta_{2009Q1-Post}\text{MHHI delta}_r + X_{rj,2009Q1} + \varepsilon_{rj}. \tag{5}$$

In a continuous-treatment version, we instrument using the raw implied change in MHHI delta, which serves as a continuous treatment variable. In a discrete-treatment version, we instrument the actual change in MHHI delta between the pre and post-period with the treatment dummy constructed based on the top and bottom terciles of the implied change in the MHHI delta, as in the above diff-in-diff analysis. We use heteroskedasticity-robust standard errors (after taking differences these are just cross-sectional regressions).

Table C.1 presents the first-stage regressions of MHHI delta on the discrete treatment instrument and several control variables. MHHI delta, either in discrete or continuous version, is a strong instrument for the actual change in the MHHI delta. Specifically, the F-stats from weak identification tests range from 59 to 290. (As one should expect, the largest values obtain for 2010Q1, right after the acquisition.) Table 6 reports the second-stage results using the continuous treatment. We find a positive and economically sizable but not statistically significant effect of the change in MHHI delta on the change in log average airfares in 2010Q1, 2011Q1 and 2013Q1, and positive and statistically significant coefficients for 2012Q1, and 2014Q1. The effect for the average or the four periods is positive and highly statistically significant, with a coefficient of 0.542, which is markedly higher than the effects estimated in panel regressions. Table C.2 shows similar results using the discrete treatment variable as an instrument. The estimated effect using the post-period 2010-2014Q1 is 0.462. Multiplying the estimates with the average MHHI delta across routes would imply that ticket prices are about 10%-12% higher because of common ownership alone, compared to a counterfactual world in which firms are separately owned, or in which firms ignore the anti-competitive incentives of their shareholders. As an alternative gauge of economic significance, note that the average implied MHHI deltais about 91 HHI points; our estimates thus indicate that ticket prices on the average U.S. airline route increased by about 0.5% as a direct result of the BlackRock-BGI acquisition.

5.2.3 Effect of Common Ownership Concentration on Passenger Volume

We now offer our forth – and perhaps simplest – response to the concern that the baseline results could be driven by reverse causality. To recapitulate, the idea is that some investors correctly anticipate demand changes in specific airlines routes and buy stakes in various carriers with high exposure to precisely those routes. Under this "anticipated demand" hypothesis, not only should there be a positive correlation between MHHI delta and prices, but also between MHHI delta and passenger volume. By contrast, if the previously documented price effects are caused by reduced supply due to higher common ownership concentration, MHHI delta should correlate negatively with passenger volume.

Table C.4 specification (1) shows results for the regressions of passenger volume on common ownership HHI, year-quarter fixed effects, and market fixed effects. The second specification adds additional market structure controls, and the third specification includes all the controls used in the saturated price regressions. In all specifications, both the HHI and the MHHI delta have a negative and significant effect on market passengers, although the magnitude of the coefficients is less stable across specifications than in the price regressions. The coefficient on the HHI ranges from -0.496 to -0.583, whereas the coefficient on MHHI delta ranges from -0.665 to -0.213 in the most saturated specification. Using the weighted average MHHI delta across markets of 2,044 in 2014Q4 to gauge economic signficance, the coefficient of around -.2 from the most saturated specification indicates that there are about 4% less market passengers in the average route than there would be under separate ownership.

These results enable us to conduct an additional consistency check. Dividing the coefficient from the quantity regressions specification (1), -0.665, by the coefficient from the price regressions specification (4), 0.325, implies an elasticity of demand in the average route of -2.05. Using specifications (2) and (5) from the quantity and price regressions, respectively, the implied elasticity is -1.95. Specifications (3) and (6) imply an elasticity of -1.05. This range of estimates is similar to that reported in the existing literature (-1.37 to -2.01 (Berry and Jia, 2010); -1.4 (IATA, 2008)).

These results indicate that increasing demand and reverse causality are unlikely to be the driver of the price effects. Instead, the results are consistent with the predictions of increased market power. In addition, the findings illustrate why the anti-competitive effects of common ownership have welfare implications: the deadweight loss to the economy comes from reduced output that accompanies higher consumer prices.

5.3 Relaxing the Proportional-Control Assumption

5.3.1 Effect of Common Ownership by Shareholder Rank

We now turn to robustness checks that are also informative about the potential corporate governance mechanisms that implement the anti-competitive shareholder incentives. In the baseline specifications reported previously, we calculated the MHHI delta using all shareholders larger than 0.5%, assuming that smaller shareholders have no significant say in corporate strategy. Consistent with this idea, including all shareholders present in the Thomson database has a minimal effect on the estimated coefficients. To further explore this idea, we now estimate specifications that assume control, for a given carrier and quarter, only by the largest 10, largest 5, largest 3, and only the single largest shareholder in the calculation of the MHHI delta. These specifications assign zero control to all shareholders outside the top N ranks, but keeps ownership rights for all shareholders. Table C.5 presents the results. Generally speaking, disregarding control rights by shareholders below the top five only slightly attenuates the point estimate, and does not affect statistical significance: the "top-five" regression yields a coefficient on MHHI delta of 0.136 in the market-carrier specification and 0.173 in the market-level specification. Taking into account control rights of only the largest three shareholders attenuates the point estimate some more; the coefficient is 0.0717 in the market-carrier specification and 0.0889 in the market-level specification; both coefficients are significant at the 1% level.

As a complement to the top-shareholder analysis, we now run a placebo test which does the opposite: we calculate the MHHI delta as if only shareholders ranked below top 10 controlled the firm. That is, for each carrier at each period in time, we assign zero control to the top 10 shareholders, and then re-calculate the MHHI deltas accordingly. If the previous results were driven by a mechanical relationship between MHHI delta and prices, or by the increase in institutional ownership in general, or by nonlinearities in the way the MHHI delta is calculated, or by the endogeneity of market shares, then one should still find a positive and significant effect even when using lower-ranked shareholders of each firm instead of the top shareholders. Instead, as shown in Table C.6, we find that the MHHI delta calculated in this way has no significant effect on ticket prices.

To get a sense for how quickly the estimated effect declines as we consider lower-ranked shareholders, we run specifications using MHHI deltas calculated as if complete control of the firm was given to shareholders of a particular rank in each firm-year-quarter. That is, we assign control equal to zero if a shareholder is not ranked first, calculate the MHHI deltas accordingly, and then run a version of the baseline specification. We then repeat the procedure but assign control equal to zero if a shareholder is not ranked second, and so on. Figure C.4 shows the estimated coefficients from this exercise for shareholders ranked 1 to 10, together with 95% confidence bands. Only common ownership by shareholders ranked first and second has a positive and highly statistically significant effect on ticket prices. Common ownership and control by shareholders ranked 3 to 10 has a small and insignificant effect on ticket prices. These results are consistent with standard notions of corporate governance, but inconsistent with the hypothesis that various forms of misspecification mechanically drive a spurious correlation between MHHI delta and ticket prices.

5.3.2 Banzhaf Voting Power Indices as Control Shares

In our calculation of the MHHI deltas, we have assumed thus far that shareholder control is proportional to the number of shares they own. As an alternative, we now calculate MHHI delta using Banzhaf indices of voting power, defined as the probability that a shareholder is pivotal in an election with two options (perhaps: directors) when the other shareholders randomize their voting with equal probability for each option. Table 4, specification (5) shows regression results with that modification relative to the benchmark. The results are similar in magnitude to the baseline, consistent with the idea that the proportional control assumption is not driving the baseline results.

5.3.3 Effect of Common Ownership by Shareholder Horizon

The previous tests indicate that only the incentives of the most powerful shareholders are reflected in airlines' pricing decisions. One might further suspect that in addition to holding large stakes, influence requires holding shares for a sufficiently long time (Chen, Harford, and Li, 2007). Indeed, an effect driven by shareholders that hold shares for only a short amount of time may exacerbate concerns about a misspecified empirical model. We measure a shareholder's horizon at a given point in time as the churn ratio, calculated as in Gaspar, Massa, and Matos (2005) (using shareholders' ownership in all industries, not just airlines). We then divide shareholders into terciles based on their churn ratios for each year-quarter, and call shareholders in the top tercile "high-churn," and shareholders in the bottom tercile "low-churn." We assign zero control to the short-horizon investors,and run the baseline specification using these modified MHHI deltas. We then repeat the exercise but additionally assign zero control to shareholders not ranked 1 or 2. The results are reported in Table 7. We find that only common ownership by long-horizon shareholders has a significant positive effect on prices, while common ownership by short-horizon shareholders yields coefficients of varying sign and weak (if any) significance. The same is true for the Ranked-1-or-2 specifications. These findings serve as yet another placebo test: MHHI delta does not appear to have a mechanical relationship to prices. Rather, only economically meaningful ways of calculating common ownership concentration are linked to significant product market outcomes.

5.4 Robustness to the Mode of Competition

The reduced-form measure of common ownership concentration we used above simply reflects the ownership networks' density. However, it can also be derived from and interpreted within a Cournot model. This feature does not imply that our empirical tests rely on the assumption that airlines necessarily compete à la Cournot, as we now show.[11]

We propose a measure of common ownership at the carrier-route level, called carrier-route common ownership (CRCO), as the market-share-weighted average of the weight that the carrier places on the profits of other carriers in the route relative to its own profits. CRCO for carrier j in route r in year-quarter t is:

$$CRCO_{jrt} = \sum_{k \neq j} \frac{\sum_i \gamma_{ij,t} \beta_{ik,t}}{\sum_i \gamma_{ij,t} \beta_{ij,t}} \frac{s_{k,rt}}{1 - s_{j,rt}}. \tag{6}$$

This measure is proportional to the Gross-Upward Pricing Pressure Index, or GUPPI, which was introduced by Hausman, Moresi, and Rainey (2011) in the context of differentiated products Bertrand competition, if diversion is proportional to market shares (as in a simple multinomial logit model), prices do not vary across carriers within a market, and markups are constant. While it is helpful to have an economic interpretation in the context of a differentiated-goods Bertrand model of competition (although under admittedly stringent assumptions), we use this measure, as we did for the MHHI delta, as a reduced-form measure of common ownership concentration. Interestingly, the measure can also be interpreted as a share-weighted average of the objective-function weights that the various firms place on the profits of competitors. Note further that CRCO uses less information about competition in the route than MHHI delta, since the latter includes information about the level of common ownership between other carriers in the same route, in addition to information about common ownership between the carrier in the observation and its competitors. To the extent that common ownership between competitors in the same route is relevant, one should thus expect the measure to have less predictive power than MHHI delta.

Table 4 specification (6) shows that the effect of the carrier-route-level common ownership measure is positive and statistically significant at the 1% level, but the t-stats are lower than

[11] That said, the strategic, longer-term pricing patterns we study are implied by capacity pre-commitments, which typically happen about one year before the flight. This feature, as well as the previous literature (Brander and Zhang, 1990), suggest a Cournot model.

those in the baseline specification for the MHHI delta, as expected. (Because the common ownership measure employed here is different from the MHHI delta, the point estimate is not quantitatively comparable to the baseline.) The loss of power is also consistent with the data favoring a Cournot model over Bertrand as the relevant model of competition in airlines, as previously argued by Brander and Zhang (1990) and the literature that followed.

To further assure robustness to the mode of competition, we investigate if the estimated effect of common ownership is driven by multi-market contact. Table 4, specification (7) shows that there is a positive and highly statistically significant effect of multi-market contact on ticket prices, measured as average route contact as in in Evans and Kessides (1994); see Ciliberto and Williams (2014) for a structural version. However, the effect of the MHHI delta remains significant and the estimated coefficients are almost unchanged.

5.5 What Else Can We Learn About the Mechanism?

We now investigate whether there are route-level differences in the effect of common ownership on ticket prices, and in particular whether there is an interaction between the degree of concentration measured by HHI and the effect of MHHI delta.[12] Such an interaction effect could arise because it might be more difficult to enforce soft competition among a large number of relatively small competitors (that is, in low-HHI routes), compared to a route in which only two players are present and have similar market shares (HHI in an intermediate range, e.g. 5,000). On the other end of the spectrum, there might be great scope in increasing monopolistic profits by creating common ownership in markets in which a small number of players still competes with a large player (i.e., markets with an HHI close to 10,000). On the other hand, there might be fewer such opportunities, making the effect more difficult to estimate. We investigate these hypotheses by running a price regression on MHHI delta interacted with a tenth-order polynomial of HHI, as well as all previously considered controls. Figure C.5 shows the results. Consistent with the above hypotheses, we find a significant effect for routes within a range of HHI between around 2,500 and 6,500.

If one entertains the possibility that investors invest time to communicate their incentives to portfolio firms, and portfolio firms exert costly effort to implement these incentives, one should expect to see that these efforts are concentrated in markets that matter more for

[12]We thank Severin Borenstein for this suggestion.

the bottom line – i.e. in larger markets. We present specifications interacting the MHHI delta with a polynomial in market size percentiles in Figure C.6. The effect of MHHI delta is statistically significant for all market size percentiles, except the very smallest and the very largest markets, for which the error bands become very wide. Indeed, the effect of the MHHI delta on prices increases with market size. This finding not only corroborates the basic narrative above, but also ensures that the main results are not driven by a small markets.

Another interesting question is to which extent variation in ownership at the firm-level over time, rather than time-variation at the firm-market level drives the results. For example, carriers may become more or less aggressive competitors due to changes in common ownership by diversified institutional investors' governance styles (Edmans, Levit, and Reilly, 2016), regardless of the specific routes they compete in. Of course, this effect is difficult to distinguish from a change in the MHHI delta, much of which is driven by firm-level variation. We can nevertheless provide a partial answer by including carrier-year-quarter fixed effects; see Table 4, specification (8). We find that the estimated coefficient of MHHI delta is lower than in the baseline but still highly statistically significant, suggesting that some, but not all, of the baseline effects derive from route-level variation. It is difficult to determine whether the attenuation is due to exacerbating measurement noise and the removal of much identifying information, or indeed due to changes in firm-level governance (or other changes at the firm-time level such as financial distress) that coincide with more common ownership.

Addressing the same question, namely at which level incentives are implemented, we implement specifications including the average of the MHHI delta across all the routes in which the carrier operates (we call this the carrier-level MHHI delta), as well as the MHHI delta in the route of the observation. Table C.7 shows that the coefficient on the route-level MHHI delta is highly statistically significant but the point estimate is lower than in the baseline estimates. Similarly, the coefficient on the carrier-level MHHI delta is statistically significant and large; it ranges from 0.91 to 1. As these results illustrate, we conduct our analyses at the route-level because doing so allows to control for route-level characteristics, but not necessarily because we believe that the majority of the effects are implemented at the route level. The majority of the effect of common ownership on competitive strategy may be implemented at the firm-pair level, or even at the firm level.

To further investigate this question, the table also shows specifications controlling for the average of the carrier-level MHHI deltas for all competitors in the same route (excluding the carrier of the observation). We call this measure the average carrier-level MHHI delta of competitors. We find that the coefficient on the route-level continues to be statistically significant, but again lower than in the baseline. The coefficient on the average carrier-level MHHI delta of other carriers is positive but not statistically significant. Section 6 provides anecdotal evidence that some shareholder initiatives appear to be focused at the route level indeed, though most publicly available evidence on shareholder engagement is broader, and at the firm-level.

5.6 External Validity

The limited availability of large-scale datasets on product prices covering a comprehensive set of producers and broad cross-section of markets makes it difficult to find other econometrically clean settings in which to test the "common ownership" theory. However, since making our study available online, similar results have been found in other industries and with other econometric methods, which may enhance confidence in the external validity of our results. In particular, Azar, Raina, and Schmalz (2016) show that the combination of common ownership and cross-ownership of US banks cause higher prices of retail deposit products, using within-bank variation across branches over time and variation in county-level common ownership that results from index fund growth as an instrument.[13] Lundin (2016) shows that joint profit maximization of commonly owned Swedish power plants best matches the data on maintenance decisions, and hence output, compared to unilateral profit maximization. Freeman (2016) finds an effect of common ownership on the longevity of customer-supplier relationships, which corroborates the assumption of the various theoretical models motivating our empirical analysis that firms internalize externalities imposed on commonly owned firms. Gutiérrez and Philippon (2017) find that in a broad cross-section of US firms, common ownership is negatively related to firms' propensity to invest amid high profitability and Q. It thus appears that the evidence for external validity of the anti-competitive effects

[13] That paper also shows that omitting common ownership from regressions of price on industry concentration (HHI) leads to a negative omitted variable bias on the HHI coefficient. Analyses of industry structure should therefore not be dismissed based on a lack of evidence that HHIs *alone* are associated with higher prices. Instead, researchers should recognize that ownership structure is part of industry structure. To analyze the effect of ownership structures on market outcomes inside an equilibrium model, a model of endogenous ownership (including endogenous portfolio choice, asset prices, governance, and strategy) would be necessary. No such model exists at this time.

hypothesis is already significant, and continues to grow.

6 Institutional Background and Potential Mechanisms

We have documented a statistical link between common ownership and higher prices. In this section, we discuss potential mechanisms, both direct and indirect, that could implement these results.

6.1 The Indirect Channel: Doing Nothing

Table 1 makes clear that much common ownership is driven by large institutional investors, and specifically by large mutual fund families. It strikes some as surprising that mutual funds, often thought to be "lazy investors" (Economist, 2015), would actively engage with portfolio firms with the aim to lessen product market competition. However, the claim that common ownership causes higher prices is very different from the claim that any shareholder actively and consciously pursues an anticompetitive agenda, communicates with managers of portfolio firms to compete less aggressively against each other, or even incites collusion. Indeed, any such notion is neither implied by our empirical results thus far, nor do the results depend on it, nor does the underlying theory suggest collusive behavior.

To see why *doing nothing* can be a sufficient mechanism by which common ownership can cause higher prices, assume that increasing market share may require costly managerial effort. Attracting new customers might require successful R&D, entering new markets may require market research and perhaps unpleasant price wars with incumbents, and expanding production capacity may likewise require effort at a personal cost. "Lazy investors" may not insist on the implementation of such expansion strategies and instead let managers get away with the "quiet life" that comes with choosing suboptimal quantities (Hicks, 1935).[14] If a match between lazy principals and lazy agents becomes pervasive in an industry, industry output declines and margins increase in a Cournot model. The powerful diversified shareholders continue to have little incentive to intervene in that case. One should of course not expect that large diversified mutual fund families actively push for more aggressive product

[14]Several initiatives by BlackRock to isolate management from activists, in the name of preventing suspected short-termism, may have this outcome as a side effect (Sorkin, 2016).

market behavior between portfolio firms, given that doing so would not only be costly, but also go against the incentive to maximize the value of the family's total portfolio. Also, we are not aware of any evidence to that effect.

By contrast, it is well documented that campaigns by activist investors, which typically concentrate their capital in one target firm per industry, lead to increases in market share of the target at the expense of its rivals (e.g. Aslan and Kumar, 2016). When various industry competitors are owned by concentrated activists that push their targets to compete aggressively, a competitive outcome obtains.

The past three decades have witnessed a shift from the low-common-ownership to the high-common-ownership equilibrium, because diversified institutions have increasingly crowded out concentrated owners as the most powerful shareholders of firms. One should thus expect a lessening of competition, even when the diversified owners do nothing at all to actively reduce the competitiveness of their portfolio firms' product markets. This may be one reason why antitrust law explicitly recognizes that a "passive" change of incentives is a sufficient mechanism to implement anticompetitive outcomes (Elhauge, 2015).

In sum, the *omission* on behalf of large diversified mutual fund families to push portfolio firms to compete aggressively against each other can implement the outcomes we empirically document. Engagement in corporate governance merely exacerbates the problem.

6.2 Effects of Influence on Corporate Financial Decisions

It is well known that financial choices can influence firms' product market strategy (Brander and Lewis, 1986; Chevalier, 1995; Kovenock and Phillips, 1995; Phillips, 1995; Dasgupta and Titman, 1998). Hence, any influence of ownership by large passive institutional investors on portfolio firm's capital structure or payout decisions can affect the product market equilibrium. For example, increased payouts imply reduced investment (at least in the long-run), but reduced investment in production capacity can imply less competitive product markets. The effects of shareholder engagement on product market outcomes can therefore be very subtle. In what follows, however, we focus on suggestive evidence that some interactions between investors and portfolio firms are directly concerned with product market considerations.

6.3 The direct channel: voice, incentives, and the vote

To start, we wish to clarify a common confusion by quoting Vanguard's CEO and Chairman: "Some have mistakenly assumed that our predominantly passive management style suggests a passive attitude with respect to corporate governance ... Nothing could be further from the truth" (Stein, 2015). Vanguard further explains "Because our funds own a significant portion of many companies (and in the case of index funds are practically permanent holders of companies), we have a vested interest in ensuring that these companies' governance ... practices support the creation of long-term value for investors." Recent research confirms that mutual fund families indeed engage much like other investors do, albeit more often "behind the scenes" (McCahery, Starks, and Sautner, 2016; Dimson, Karakaş, and Li, forthcoming; Appel, Gormley, and Keim, 2016; Mullins, 2014; Boone and White, forthcoming; Schmidt and Fahlenbrach, forthcoming), and sometimes coordinated in "secret summits" (Foley and McLannahan, 2016). By now, it is however well recognized that the largely "passive" asset management firms such as BlackRock, Vanguard, State Street, and Fidelity play a decisive role in most corporate governance decisions of publicly traded firms in America; their power has been compared to that of J.P. Morgan and John D. Rockefeller (Krouse, Benoit, and McGinty, 2016).

We now present evidence suggesting that some common owners indeed (i) use *voice* to make understood their preferred product market strategies, that they can (ii) structure *incentives*, i.e. pay, of commonly owned firms' top managers in ways that reward less aggressive competition, and that they can (iii) use the power of their *vote* to silence dissenting undiversified shareholders that push for more competition.

6.3.1 Voice

According to large asset managers, making their voice heard in private engagement meetings is the most important mechanism by which they influence corporate governance. According to their websites and letters to CEOs, some of the large "passive" asset managers have requested that firms provide them with long-term strategic plans regarding growth and profitability, and clarify that managers will be evaluated based on their implementation of those strategic plans. Vanguard also has "hundreds of direct discussions [with portfolio firms] every year;" BlackRock has claimed more than a thousand private meetings in previous governance reports. An open question is to which extent product market strategy is part of the conversations between institutional investors and portfolio firms. It is known that activists occasionally demand board seats to ensure implementation of the desired product market strategy; Reuters (2008) reports on such an event in the airline industry. Moreover, Chen (2016) reports that amid rising political pressure to reduce drug prices, the mutual fund companies Fidelity, T. Rowe Price, and Wellington invited several pharma managers to a Boston hotel and encouraged them to "defend their pricing." Levine (2016) cites a portfolio manager at Hodges Capital Management Inc. as "I'd like to see [Southwest Airlines] boost their fares but also cut capacity," and notes that Hodges owns shares in airlines including United Continental, Delta, American, Alaska and Virgin America, as well as Southwest. The business press is concerned about the potential for "monopolistic behavior" by Warren Buffett despite the classification of Berkshire Hathaway's airline holdings as "passive" investments (Quick, 2016). Flaherty and Kerber (2016) report that the alleged Hart-Scott-Rodino Antitrust Act violation by an activist with common ownership interests in natural competitors (Flaherty and Bartz, 2016) "could call into question routine practices across ... the mutual fund industry," noting that "some communications the government cites as evidence are similar to discussions that ... traditional, buy-and-hold funds" commonly have with their portfolio firms. FAZ (2016) features a top manager of a mutual fund family stating which competitors a specific portfolio firm should (not) consider for a merger in response to a perceived excessive level of competition. Flaherty and Kerber (2016) further report that "activists court passive shareholders before launching such a campaign, and passive investors recruit activists to agitate, [...] blurring boundaries between activist and traditional fund managers."[15] However, because large asset managers (e.g. BlackRock, 2011) appear to find private communications about "nuanced and sensitive" topics more beneficial than public statements, explicit knowledge about the level of detail at which product market strategy is discussed remains limited.

Given the scarcity of information on the contents of private engagement meetings, we turn to public earnings calls of U.S. airlines to understand at which level of detail investors and management discuss product market strategy. We find that route-level capacity decisions are a frequent topic of conversation. For example, a representative of a financial institution

[15] The Federal Trade Commission has since clarified that "'Investment-only' means just that" (Feinstein, Libby, and Lee, 2015).

ranking among the top five owners of various airlines criticizes management for "growth initiatives out of LA, Seattle," asks whether capacity increases to "Miami, Frankfurt could have an effect of reducing some of the existing service here," cautions management that "adding capacity into other airlines' hubs diminishes your shareholders' confidence and jeopardizes [your stock price]," and notes elsewhere that his questions are "not uniquely directed" and similar to conversations he has with "others this season." We conclude that anecdotal evidence exists that investors and portfolio firms discuss product market strategy, sometimes even at the market level. Do managers also have the incentives to act in line with common owners' economic interests?

6.3.2 Incentives

Actively managed funds can threaten management with selling the stock in case management does not adhere to their desired product market strategy, which may explicitly feature not entering competitors' markets (Reuters, 2008). Thus-caused declines in stock prices would have obvious direct consequences for managerial incentives. However, many firms' largest shareholders are "passive" institutions, and don't have that option. Yet, they have the power to shape managerial incentives. "Passive" investors claim to address the structure of management pay in 45% of engagement meetings; perhaps not surprisingly, after such engagement, they almost always vote for the proposed plans, with the results that incentives are often much less sensitive to (relative) performance than other investors demand (Melby and Ritcey, 2016; Melin, 2016). A lack of relative performance incentives gives managers reduced incentives to compete.

Indeed, there is a long literature in economics rationalizing the scarcity of relative-performance incentives by shareholders' strategic design of managerial contracts as to implement their desired product market strategy and soften competition (e.g. Fershtman and Judd, 1987; Sklivas, 1987; Aggarwal and Samwick, 1999). Antón, Ederer, Giné, and Schmalz (2016) show that common owners have incentives to reduce relative performance incentives, either actively or by omitting to support other shareholders' initiatives to implement relative performance incentives.[16] A caveat is that explicit incentives are only in place as long

[16] Whether the factual incentives in place conform to the theoretical predictions is a presently discussed empirical question. Antón, Ederer, Giné, and Schmalz (2016) provide panel and IV evidence that management pay becomes less sensitive to performance relative to industry rivals when the industry becomes more

as the manager is not fired. However, CEO turnover also does not feature strong elements of relative performance evaluation, and is therefore sensitive to industry performance (Jenter and Kanaan, forthcoming). Hence, career concerns also give managers incentives to maintain a "healthy" industry profitability. We conclude that compensation contracts can be used to align managers' strategic incentives with those of shareholders.

6.3.3 Vote

Voting against management is the ultimate step in ensuring alignment of incentives between shareholders and their agents. BlackRock's proxy voting guidelines indicate "We typically only vote against management when direct engagement has failed." Colloquially, engagement is the carrot – voting is the stick. Similarly, the head of corporate governance at State Street Global Advisors believes "The option of exercising our substantial voting rights in opposition to management provides us with sufficient leverage and ensures our views and client interests are given due consideration" (Scott, 2014).

Of course, shareholders do not directly vote on competitive strategies. However, they do vote on director candidates. Consistent with a less-than-perfectly-passive approach to governance on behalf of the large "passive" institutions, "boards now routinely vet director candidates with major shareholders before their names are placed on the proxy" (Charan, Useem, and Carey, 2015). Director candidates may be able to credibly signal for which type of competitive strategy they stand. For example, Berkshire Hathaway's Co-CIO would reduce the Berkshire portfolio value if he used his role as a JP Morgan board member to propose a particularly aggressive competitive strategy against American Express, Bank of America, or Wells Fargo, in all of which Berkshire Hathaway is a major or the largest investor (Buhayar, 2016). Azar (2012, 2017) shows theoretically that shareholder voting on directors and managers can lead firms to act as if they maximized an objective function similar to the one assumed in the derivation of the common ownership concentration index we use in our empirical work.[17] Fos and Tsoutsoura (2014); Aggarwal, Dahiya, and Prabhala (2015) show

commonly owned, and show that wealth-performance-sensitivities decline with common ownership. Liang (2016) independently corroborates that pay-performance-sensitivities decline with common ownership, using firm-level variation, alternative functional forms, and a different identification strategy. Kwon (2016) challenges existing theory and empirical findings using alternative samples, industry definitions, and empirical specifications, claiming qualitatively opposite results on pay-performance sensitivities, and documents a link between common ownership and the explicit use of relative performance in compensation contracts.

[17] Early models of voting on production choices and the internalization of production externalities include

empirically that director elections matter because of career concerns.

6.4 Summary

We find that voice, incentives, and vote – as well as the simple omission to push for more aggressive competition – can plausibly implement the anticompetitive incentives of investors that hold large stakes in natural competitors. Schmalz (2015) provides a case study that illustrates all four elements. An activist investor with concentrated holdings in a target *voices* a demand for greater efforts at increasing market share vis-à-vis the target's competitors, as well as a greater use of relative performance evaluation to give management appropriate *incentives* to maximize the target's value, among other things. Institutional Shareholder Services recommends to support the activist's campaign, but BlackRock, Vanguard, and StateStreet cast decisive *votes* against. "The most plausible hypothesis is that the large asset managers are concerned about the impact of hedge fund activism on their broader portfolio"(Coffee, 2015).[18] Moreover, it is possible to interpret the event as an *omission* on behalf of the "passive" investors to either implement pro-competitive measures themselves or to support a campaign that would have likely caused more aggressive competition. The case thus illustrates the silent shift of power from concentrated to diversified investors.

Because there are many plausible channels through which shareholder incentives can translate into firm behavior, we find it unlikely that one single mechanism is solely responsible. This insight is important, as it suggests that the common ownership problem is unlikely to be solved by shutting down a particular channel. For example, managers are unlikely to be isolated from common owners' anti-competitive incentives when regulators prohibit communication about subjects of competition, while conversations about pay structure or voting on board members continue to be permitted. Moreover, given that "doing nothing" is one of the possible mechanisms, finding conclusive evidence for a mechanism could prove elusive even if a robust causal relation exists.

Benninga and Muller (1979); DeMarzo (1993); Crès and Tvede (2005), see also Dekel, Jackson, and Wolinsky (2008); Dekel and Wolinsky (2012); Casella, Llorente-Saguer, and Palfrey (2012).

[18] Whereas the big "passive" fund families vote against activists more often than not, they do so selectively. The empirical study of what types of campaigns they tend to support is challenging not only because of the difficulty of classifying campaigns with multiple objectives, but also because of a selection effect: researchers do not observe the proxy fights that didn't happen because of expected opposition by the "passive" funds (see Ackman, 2016).

7 Conclusion

This paper presents evidence of large anti-competitive incentives due to common ownership links at the market level, and empirical results indicative (but of course not conclusive) of a causal link between common ownership and higher product prices. In particular, in the US airline industry, a modified index of market concentration that takes into account to which extent competitors are commonly owned by the same investors indicates levels of market concentration that far exceed those indicated by the conventional measure of market concentration. Common ownership concentration for the average route is more than ten times larger than what would be presumed "to be likely to enhance market power" in the case of a traditional merger, according to the US Antitrust Agencies' Horizontal Merger Guidelines. In theory, the additional concentration that results from cumulating many small common ownership interests should get reflected in higher prices.

We find that when firms have reduced incentives to compete due to common ownership, prices are higher and output is lower. Specifically, using fourteen years of market-firm-level quarterly panel data, we find that airline ticket prices are 3-7% higher because of common ownership, compared to a counterfactual world in which firms are separately owned, or in which firms entirely ignore their owners' anti-competitive incentives caused by common ownership. We then exploit variation in common ownership concentration generated by the merger of two large asset managers that arguably occurred for reasons unrelated to expected route-level differences in US airline ticket prices, and find that product prices are 10-12% higher due to common ownership. These results suggest both a large deadweight loss (i.e. decreased efficiency of the economy) and a large transfer from consumers to producers due to common ownership.

If robust, our findings raise several questions for academic research in industrial organization, finance, and legal studies. Specifically, a ubiquitous assumption in finance research is that firms' objective is to maximize their own value, and that firm policies and investors' optimization problems are separable. Our results can be viewed as challenging this assumption, and thus make an empirical case for taking seriously the theoretical insight (perhaps most clearly stated in Hart, 1979) that shareholders do not agree on profit maximization as an objective when firms are not price takers. An open question is then what *is* the objective of the firm, and how it might be determined through interactions of shareholders with varying interests. The objective assumed in the derivation of the MHHI is but one candidate.[19]

Tackling the competitive risks due to common ownership also presents challenges to policy makers, not only from a political but also from a conceptual perspective. Specifically, this paper emphasizes the empirical importance to decide on the optimal mix between three desirable but not jointly attainable goals of a capitalist system. When firms implement shareholders' incentives, and all shareholders (including those with significant control) are fully diversified, product market competition will tend towards monopolistic outcomes, with an associated deadweight loss for the economy. The three goals of (i) perfect shareholder diversification, (ii) firms' maximization of shareholder interests ("good governance"), and (iii) preservation of competitive product markets can therefore not be simultaneously achieved (Azar, 2012). The first two goals benefit shareholders. By contrast, the decline in product market competition implied by an improved implementation of the first two goals is a social cost that has thus far been largely ignored. However, the implications of decreased competition such as increased inequality, slow macroeconomic growth and low real interest rates despite sustained and high profit margins are of much interest to policy makers and the population at large (Elhauge, 2015; Summers, 2016; Stiglitz, 2016). What is the optimal tradeoff between the above three goals is therefore already a hotly debated question in the public domain (Posner, Scott Morton, and Weyl, forthcoming, 2016; Novick, 2017).

Whereas we do not propose a solution for the tradeoff illustrated above, two direct policy implication of the present paper arise at a more practical level. First, empirical measures of market concentration should take ownership into account. Secondly, regulators should keep in mind that consolidation in the asset management industry can adversely affect competition in the product markets of their portfolio companies. Therefore, when antitrust authorities evaluate such propositions, the potential benefits to shareholders need to be weighed against the potential loss of consumer surplus – not just for consumers of asset management products, but also for consumers of the products offered by portfolio firms.

Whereas this paper emphasizes anti-competitive effects of common ownership, in theory, common ownership can also have efficiency-enhancing effects. Which effect prevails is an empirical question that goes beyond the scope of our paper, which merely intends to start the debate.

[19] As for the fast-growing literature on the implications of our findings for antitrust and corporate law, we refer the reader to Elhauge (2015); Baker (2016) and various responses to those papers.

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Table 1: Illustrative Cases of Within-industry Common Ownership Links.

This table shows the largest (institutional and non-institutional) beneficial owners and corresponding stakes for an illustrative sample of US publicly traded natural competitors as of 2016Q2. The data source is S&P Capital IQ; Panel C corresponds to Azar, Raina, and Schmalz (2016). Berkshire's holdings in Bank of America (*) are warrants without voting rights.

Panel A: Technology Firms

Apple	*[%]*	*Microsoft*	*[%]*
Vanguard	6.05	Vanguard	6.41
BlackRock	5.72	BlackRock	5.80
State Street	3.82	Capital Research	4.76
Fidelity	2.34	- Steve Ballmer -	4.24
Northern Trust Corporation	1.26	State Street	3.80
		- Bill Gates -	2.54
		T. Rowe Price	2.27

Panel B: Pharmacies

CVS	*[%]*	*Walgreens Boots Alliance*	*[%]*	*Rite Aid*	*[%]*
Vanguard	6.66	-Stefano Pessina-	13.06	Vanguard	7.24
BlackRock	6.02	Vanguard	5.58	BlackRock	4.20
State Street	4.00	BlackRock	4.55	Arrowgrass Capital	3.55
Fidelity	3.67	KKR	3.38	Franklin Resources	2.87
Wellington	2.37	State Street	3.34	Pentwater Capital	1.89
		T. Rowe Price	2.70		

Panel C: Banks

JP Morgan Chase	*[%]*	*Bank of America*	*[%]*	*Citigroup*	*[%]*
Vanguard	6.28	Berkshire Hathaway*	6.90	BlackRock	6.43
BlackRock	6.28	Vanguard	5.94	Vanguard	5.96
State Street	4.12	BlackRock	5.94	State Street	4.04
Capital Research	3.68	State Street	4.01	Fidelity	3.00
Fidelity	2.10	Fidelity	2.37	Invesco	1.67
Wells Fargo	*[%]*	*PNC Financial*	*[%]*	*U.S. Bancorp*	*[%]*
Berkshire Hathaway	10.46	Wellington	8.34	BlackRock	6.51
Vanguard	5.67	Vanguard	6.30	Berkshire Hathaway	5.94
BlackRock	5.42	BlackRock	5.03	Vanguard	5.59
State Street	3.68	State Street	4.33	Fidelity	4.12
Wellington	2.55	Barrow Hanley	3.71	State Street	3.84

Table 1: Illustrative Cases of Within-industry Common Ownership Links (continued)

The data source is Capital IQ and reflects holdings as of 2016Q4.

Delta Air Lines	*[%]*	*Southwest Airlines Co.*	*[%]*	*American Airlines*	*[%]*
Berkshire Hathaway	8.25	PRIMECAP	11.78	T. Rowe Price	13.99
BlackRock	6.84	Berkshire Hathaway	7.02	PRIMECAP	8.97
Vanguard	6.31	Vanguard	6.21	Berkshire Hathaway	7.75
State Street Global Advisors	4.28	BlackRock	5.96	Vanguard	6.02
J.P. Morgan Asset Mgt.	3.79	Fidelity	5.53	BlackRock	5.82
Lansdowne Partners Limited	3.60	State Street Global Advisors	3.76	State Street Global Advisors	3.71
PRIMECAP	2.85	J.P. Morgan Asset Mgt.	1.31	Fidelity	3.30
AllianceBernstein L.P.	1.67	T. Rowe Price	1.26	Putnam	1.18
Fidelity	1.54	BNY Mellon Asset Mgt.	1.22	Morgan Stanley	1.17
PAR Capital Mgt.	1.52	Egerton Capital (UK) LLP	1.10	Northern Trust Global Inv	1.02

United Continental Holdings	*[%]*	*Alaska Air*	*[%]*	*JetBlue Airways*	*[%]*
Berkshire Hathaway	9.20	T. Rowe Price	10.14	Vanguard	7.96
BlackRock	7.11	Vanguard	9.73	Fidelity	7.58
Vanguard	6.88	BlackRock	5.60	BlackRock	7.33
PRIMECAP	6.27	PRIMECAP	4.95	PRIMECAP	5.91
PAR Capital Mgt.	5.18	PAR Capital Mgt.	3.65	Goldman Sachs Asset Mgt.	2.94
State Street Global Advisors	3.45	State Street Global Advisors	3.52	Dimensional Fund Advisors	2.42
J.P. Morgan Asset Mgt.	3.35	Franklin Resources	2.59	State Street Global Advisors	2.40
Altimeter Capital Mgt.	3.26	BNY Mellon Asset Mgt.	2.34	Wellington	2.07
T. Rowe Price	2.25	Citadel	1.98	Donald Smith Co.	1.80
AQR Capital Management	2.15	Renaissance Techn.	1.93	BarrowHanley	1.52

Spirit Airlines	*[%]*	*Allegiant Travel Company*	*[%]*	*Hawaiian*	*[%]*
Fidelity	10.70	Gallagher Jr., M. J. (Chairman, CEO)	20.30	BlackRock	11.20
Vanguard	7.41	BlackRock	8.61	Vanguard	10.97
Wellington	5.44	Renaissance Techn.	7.28	Aronson, Johnson, Ortiz, LP	5.99
Wasatch Advisors Inc.	4.33	Vanguard	6.65	Renaissance Techn.	4.67
BlackRock	3.77	Fidelity	5.25	Dimensional Fund Advisors	3.17
Jennison Associates	3.49	Franklin Resources	4.52	State Street Global Advisors	2.43
Wells Capital Mgt.	3.33	Wasatch Advisors Inc.	4.39	PanAgora Asset Mgt.	2.22
Franklin Resources	2.79	T. Rowe Price	4.23	LSV Asset Management	2.22
OppenheimerFunds.	2.67	TimesSquare Capital Mgt.	3.91	BNY Mellon Asset Mgt.	1.84
Capital Research and Mgt.	2.64	Neuberger Berman	3.07	Numeric Investors	1.79

Table 2: Summary Statistics.

Data for the period 2001Q1-2014Q4 come from the Department of Transportation for airfares and market characteristics. Data on ownership come from 13f filings and proxy statements. We exclude routes with less than 20 passengers per day on average. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix.

	Mean	**Std. Dev.**	**Min.**	**Max.**	**N**
Market-Carrier Level:					
Average Fare	229.16	97.5	25	2498.62	1312778
Log Average Fare	5.37	0.36	3.22	7.82	1312778
HHI	4639.46	2076.81	971.16	10000	1312778
MHHI	6493.13	1654.73	2039.11	10218.54	1243621
MHHI delta	1870.24	1127.29	0	5798.57	1243621
Number of Nonstop Carriers	0.81	1.3	0	11	1312778
Southwest Indicator	0.09	0.29	0	1	1312778
Other LCC Indicator	0.09	0.28	0	1	1312778
Share of Passengers Traveling Connect, Market-Level	0.67	0.39	0	1	1312778
Share of Passengers Traveling Connect	0.86	0.32	0	1	1312778
Population	2.42	2.01	0.02	16.32	1215267
Income Per Capita	41.89	4.9	21.53	92.5	1215267
Distance	2686.52	1552.06	27	12714	1312778
Average Passengers	3930.37	11590.52	10	234146	1312778
Market-Level:					
Average Fare	219.31	72.52	29.66	1045.88	282333
Log Average Fare	5.34	0.33	3.39	6.95	282333
HHI	5264.44	2370.44	971.16	10000	282333
MHHI	6976.12	1767.65	2039.11	10218.54	262766
MHHI delta	1731.44	1206.51	0	5798.57	262766
Number of Nonstop Carriers	0.73	1.19	0	11	282333
Southwest Indicator	0.09	0.29	0	1	282333
Other LCC Indicator	0.08	0.27	0	1	282333
Share of Passengers Traveling Connect, Market-Level	0.64	0.41	0	1	282333
Share of Passengers Traveling Connect	0.64	0.41	0	1	282333
Population	2.28	1.97	0.02	16.32	255384
Income Per Capita	41.59	5.06	21.53	92.5	255384
Distance	2342.93	1520.76	27	11920.14	282333
Average Passengers	18428.79	33341.41	1800	386097.72	282333
Correlation Between HHI and MHHI: 0.87					
Correlation Between HHI and MHHI delta: -0.69					

Table 3: Effect of Common Ownership on Airline Ticket Prices: Panel Regressions.

Common ownership is measured as MHHI delta. Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare)					
	Market-carrier level			Market-level		
	(1)	(2)	(3)	(4)	(5)	(6)
MHHI delta	0.194***	0.219***	0.149***	0.325***	0.311***	0.202***
	(0.0459)	(0.0387)	(0.0375)	(0.0446)	(0.0397)	(0.0356)
HHI	0.221***	0.230***	0.165***	0.365***	0.357***	0.255***
	(0.0247)	(0.0246)	(0.0209)	(0.0315)	(0.0313)	(0.0244)
Number of Nonstop Carriers			-0.00979***			-0.00810**
			(0.00269)			(0.00371)
Southwest Indicator			-0.120***			-0.149***
			(0.00928)			(0.0135)
Other LCC Indicator			-0.0618***			-0.100***
			(0.00717)			(0.00989)
Share of Passengers Traveling Connect, Market-Level			0.124***			0.158***
			(0.0167)			(0.0189)
Share of Passengers Traveling Connect			0.0986***			
			(0.0143)			
Log(Population)			0.306***			0.343***
			(0.106)			(0.122)
Log(Income Per Capita)			0.374***			0.304***
			(0.102)			(0.110)
Log(Distance) × Year-Quarter FE		✓	✓		✓	✓
Year-quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓			
Market FE				✓	✓	✓
Observations	1,237,584	1,237,584	1,209,517	262,350	262,350	254,999
R-squared	0.820	0.825	0.836	0.852	0.861	0.876
Number of market-carrier pairs	46,513	46,513	45,248			
Number of markets				7,185	7,185	6,906

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Effect of Common Ownership on Airline Ticket Prices: Robustness.

Common ownership is measured as MHHI delta. Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions. The Banzhaf control shares are calculated by Monte-Carlo simulation, using 10,000 random draws for each firm-year-quarter.

	Dependent Variable: Log(Average Fare)							
	Excl. Bankruptcy Periods	Inst. Ownership Vars.	City-Pairs	HHI Polynomial	Banzhaf	CRCO	Multi-Market Contact	Carrier-Time FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MHHI delta	0.265***	0.235***	0.287***	0.183***	0.181***		0.192***	0.0765***
	(0.0535)	(0.0354)	(0.0398)	(0.0363)	(0.0352)		(0.0352)	(0.0270)
Carrier-Route Common Ownership						0.0347***		
						(0.0112)		
Log(Multi-Market Contact)							0.0457***	
							(0.00537)	
HHI	0.290***	0.261***	0.401***		0.247***	0.125***	0.258***	0.115***
	(0.0293)	(0.0232)	(0.0381)		(0.0243)	(0.0174)	(0.0233)	(0.0167)
Number of Nonstop Carriers	-0.0149***	-0.00886**	0.00335	-0.00803**	-0.00814**	-0.0100***	-0.00718**	-0.0113***
	(0.00523)	(0.00359)	(0.00301)	(0.00364)	(0.00371)	(0.00268)	(0.00353)	(0.00213)
Southwest Indicator	-0.141***	-0.140***	-0.119***	-0.147***	-0.149***	-0.117***	-0.150***	-0.106***
	(0.0160)	(0.0132)	(0.0122)	(0.0136)	(0.0135)	(0.00927)	(0.0135)	(0.00862)
Other LCC Indicator	-0.0907***	-0.0986***	-0.0443***	-0.0992***	-0.101***	-0.0656***	-0.0907***	-0.0579***
	(0.0117)	(0.00992)	(0.0101)	(0.00996)	(0.00993)	(0.00731)	(0.00956)	(0.00631)
Share of Passengers Traveling Connect, Market-Level	0.132***	0.152***	0.291***	0.170***	0.158***	0.133***	0.151***	0.107***
	(0.0227)	(0.0193)	(0.0210)	(0.0187)	(0.0189)	(0.0162)	(0.0195)	(0.0151)
Share of Passengers Traveling Connect						0.0940***		0.133***
						(0.0146)		(0.0140)
Log(Population)	0.540***	0.273**	0.454***	0.338***	0.346***	0.304***	0.328**	0.137*
	(0.133)	(0.122)	(0.139)	(0.123)	(0.123)	(0.108)	(0.127)	(0.0800)
Log(Income Per Capita)	0.422***	0.285**	0.240**	0.303***	0.306***	0.374***	0.302**	0.215***
	(0.145)	(0.107)	(0.104)	(0.109)	(0.110)	(0.102)	(0.117)	(0.0757)
Percent Institutional Ownership		-0.0762***						
		(0.0187)						
Institutional Ownership Concentration		-0.110*						
		(0.0568)						
Top 5 Holdings as Pct. of Total Institutional Holdings		0.154***						
		(0.0420)						
Log(Distance) × Year-Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
10-th Order Polynomial in HHI				✓				
Year-quarter FE	✓	✓	✓	✓	✓	✓	✓	
Market-Carrier FE						✓		✓
Market FE	✓	✓	✓	✓	✓		✓	
Carrier-Year-Quarter FE								✓
Observations	127,128	254,999	201,983	254,999	254,999	1,209,517	244,257	1,209,496
R-squared	0.886	0.878	0.890	0.877	0.876	0.836	0.874	0.855
Number of markets	6,470	6,906	5,305	6,906	6,906		6,553	
Number of market-carrier pairs						45,248		45,243

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Effect of Common Ownership on Airline Ticket Prices: Distributed-Lags Regressions. Common ownership is measured as MHHI delta. Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare)					
	Market-carrier level			Market-level		
	(1)	(2)	(3)	(4)	(5)	(6)
MHHI delta - Lead	-0.0722	-0.0397	-0.0502	-0.0176	0.000444	-0.0224
	(0.0618)	(0.0531)	(0.0497)	(0.0620)	(0.0535)	(0.0496)
MHHI delta	0.110	0.104	0.0452	0.181*	0.159**	0.0802
	(0.0918)	(0.0710)	(0.0669)	(0.0917)	(0.0726)	(0.0666)
MHHI delta - Lag	0.159**	0.170***	0.161***	0.178**	0.177***	0.162***
	(0.0693)	(0.0538)	(0.0506)	(0.0685)	(0.0544)	(0.0492)
HHI - Lead	0.0252	0.0412*	0.0132	0.0650**	0.0592**	0.0362
	(0.0254)	(0.0226)	(0.0218)	(0.0261)	(0.0251)	(0.0246)
HHI	0.00598	0.00260	-0.00494	0.0775**	0.0893***	0.0405
	(0.0353)	(0.0282)	(0.0261)	(0.0384)	(0.0326)	(0.0297)
HHI - Lag	0.218***	0.220***	0.182***	0.274***	0.256***	0.214***
	(0.0290)	(0.0254)	(0.0237)	(0.0298)	(0.0269)	(0.0248)
Number of Nonstop Carriers			-0.00906***			-0.00703*
			(0.00267)			(0.00369)
Southwest Indicator			-0.119***			-0.149***
			(0.00950)			(0.0135)
Other LCC Indicator			-0.0616***			-0.0983***
			(0.00713)			(0.00984)
Share of Passengers Traveling Connect, Market-Level			0.137***			0.158***
			(0.0162)			(0.0195)
Share of Passengers Traveling Connect			0.0699***			
			(0.0142)			
Log(Population)			0.280**			0.323**
			(0.105)			(0.122)
Log(Income Per Capita)			0.345***			0.288***
			(0.0975)			(0.107)
Log(Distance) × Year-Quarter FE		✓	✓		✓	✓
Year-quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓			
Market FE				✓	✓	✓
Observations	1,002,802	1,002,802	982,245	221,674	221,674	216,175
R-squared	0.836	0.841	0.851	0.857	0.865	0.879
Number of market-carrier pairs	35,840	35,840	35,038			
Number of markets				5,872	5,872	5,698

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Effect of Common Ownership on Airline Ticket Prices: IV Regressions Using Continuous Treatment: Second Stage.

Common ownership is measured as MHHI delta. 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. We use the resulting implied change in MHHI delta as a continuous treatment variable. We exclude markets with less than 20 passengers per day on average. We exclude market carriers with any missing observations during the period 2006Q2-2014Q4. We weight by passengers the market carrier in 2009Q1. Standard errors are robust to heteroskedasticity. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Change in Log(Average Fare) 2009Q1-Post					
Post-period:	2010Q1 (1)	2011Q1 (2)	2012Q1 (3)	2013Q1 (4)	2014Q1 (5)	2010-2014 Q1 (6)
Change in MHHI delta 2009Q1-Post	0.193	0.256	0.816***	0.413	0.963***	0.542***
	(0.135)	(0.299)	(0.188)	(0.261)	(0.225)	(0.175)
HHI_{2009Q1}	0.0271	0.0365	0.00920	0.0536	0.0998*	0.0427
	(0.0340)	(0.0492)	(0.0445)	(0.0496)	(0.0594)	(0.0395)
Number of Nonstop $Carriers_{2009Q1}$	0.0102**	0.0130**	0.00723	0.0178***	0.0148**	0.0123**
	(0.00466)	(0.00613)	(0.00623)	(0.00567)	(0.00693)	(0.00529)
Southwest $Indicator_{2009Q1}$	0.0257**	0.0474***	0.0574***	0.0872***	0.0928***	0.0598***
	(0.0129)	(0.0143)	(0.0151)	(0.0159)	(0.0193)	(0.0130)
Other LCC $Indicator_{2009Q1}$	-0.0174	-0.0384**	-0.0229	-0.0176	-0.0120	-0.0220
	(0.0141)	(0.0164)	(0.0159)	(0.0170)	(0.0186)	(0.0140)
Share of Passengers Traveling $Connect_{2009Q1}$	0.0314***	0.0648***	0.0324**	0.0233*	0.0331**	0.0375***
	(0.0105)	(0.0125)	(0.0127)	(0.0140)	(0.0159)	(0.0107)
Share of Passengers Traveling Connect, Market-$Level_{2009Q1}$	-0.0442*	-0.00524	-0.00960	0.146***	0.0822**	0.0295
	(0.0244)	(0.0304)	(0.0321)	(0.0314)	(0.0385)	(0.0264)
Log $(Population)_{2009Q1}$	-0.0111	0.00469	-0.0216**	-0.00112	-0.00171	-0.00497
	(0.00872)	(0.00975)	(0.0106)	(0.00992)	(0.0110)	(0.00873)
Log (Income Per $Capita)_{2009Q1}$	-0.0663*	0.0424	0.0325	0.129***	-0.000717	0.0285
	(0.0394)	(0.0417)	(0.0487)	(0.0498)	(0.0559)	(0.0377)
Log $(Distance)_{2009Q1}$	-0.00772	-0.0321***	-0.0371***	-0.0448***	-0.0679***	-0.0380***
	(0.00719)	(0.00769)	(0.00846)	(0.00813)	(0.00939)	(0.00662)
Share DL × Share NW in 2008Q4	0.199	0.224	0.514*	0.689**	0.378	0.457*
	(0.234)	(0.247)	(0.265)	(0.292)	(0.404)	(0.234)
Share UA × Share CO in 2009Q1	0.120	1.033***	1.166***	1.642***	1.718***	1.092***
	(0.194)	(0.370)	(0.369)	(0.419)	(0.378)	(0.251)
Share AA × Share US in 2009Q1	0.437**	0.338	0.821***	0.831***	1.304***	0.705***
	(0.171)	(0.328)	(0.292)	(0.260)	(0.366)	(0.228)
Share FL × Share WN in 2009Q1	-0.0478	0.222	1.293***	0.823***	1.236***	0.647***
	(0.221)	(0.232)	(0.287)	(0.301)	(0.332)	(0.241)
Share AA in 2009Q1	-0.00878	0.00366	-0.00903	-0.0196	0.00674	-0.00548
	(0.0207)	(0.0250)	(0.0260)	(0.0253)	(0.0267)	(0.0205)
Percent Change in Income during Great Recession	-0.133	0.0828	0.0257	-0.348*	-0.287	-0.128
	(0.142)	(0.162)	(0.189)	(0.199)	(0.207)	(0.149)
Constant	0.318**	0.113	0.231	-0.200	0.412*	0.177
	(0.155)	(0.164)	(0.185)	(0.189)	(0.217)	(0.148)
Observations	5,022	5,022	5,022	5,022	5,022	5,022
R-squared	0.043	0.089	0.068	0.108	0.002	0.096

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Effect of Common Ownership by High-Churn and Low-Churn Investors on Airline Ticket Prices.

Data are for the period 2001Q1-2014Q4. We exclude routes with less than 20 passengers per day on average. We defineFor the market-carrier-level regressions, we weight by average passengers for the market carrier over time and cluster standard errors two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. We calculate the MHHI delta setting the control rights to zero for shareholders outside the bottom tercile of the churn ratio, and then for shareholders outside the top tercile of the churn ratio for each market-carrier and date. The churn ratio is calculated as in Gaspar, Massa, and Matos (2005).We then repeat the calculation but also shutting down shareholders not ranked 1 or 2 at a given carrier-year-quarter. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare)							
	Shareholders of Any Rank				Shareholders Ranked 1 or 2			
	Market-carrier level		Market-level		Market-carrier level		Market-level	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MHHI delta (High-Churn Shareholders)	0.0229		0.0397					
	(0.0262)		(0.0287)					
MHHI delta (Low-Churn Shareholders)		0.0562***		0.0738***				
		(0.0141)		(0.0161)				
MHHI delta (High-Churn Shareholders Ranked 1 or 2)					-0.0451		-0.0234	
					(0.0347)		(0.0372)	
MHHI delta (Low-Churn Shareholders Ranked 1 or 2)						0.0475**		0.0608***
						(0.0204)		(0.0222)
HHI	0.129***	0.157***	0.206***	0.241***	0.124***	0.132***	0.199***	0.208***
	(0.0179)	(0.0182)	(0.0214)	(0.0224)	(0.0175)	(0.0172)	(0.0212)	(0.0210)
Number of Nonstop Carriers	-0.0102***	-0.0102***	-0.00870**	-0.00860**	-0.0101***	-0.0100***	-0.00862**	-0.00848**
	(0.00269)	(0.00269)	(0.00376)	(0.00372)	(0.00271)	(0.00270)	(0.00378)	(0.00375)
Southwest Indicator	-0.118***	-0.117***	-0.147***	-0.146***	-0.118***	-0.119***	-0.147***	-0.148***
	(0.00938)	(0.00926)	(0.0138)	(0.0136)	(0.00941)	(0.00936)	(0.0138)	(0.0137)
Other LCC Indicator	-0.0665***	-0.0641***	-0.107***	-0.104***	-0.0677***	-0.0661***	-0.109***	-0.107***
	(0.00762)	(0.00741)	(0.0104)	(0.0103)	(0.00755)	(0.00745)	(0.0104)	(0.0103)
Share of Passengers Traveling Connect, Market-Level	0.132***	0.129***	0.164***	0.164***	0.134***	0.133***	0.165***	0.165***
	(0.0160)	(0.0164)	(0.0186)	(0.0187)	(0.0162)	(0.0162)	(0.0188)	(0.0187)
Share of Passengers Traveling Connect	0.0957***	0.0972***			0.0952***	0.0952***		
	(0.0144)	(0.0144)			(0.0144)	(0.0144)		
Log(Population)	0.298***	0.286**	0.329**	0.318**	0.302***	0.297***	0.334**	0.329**
	(0.109)	(0.108)	(0.127)	(0.125)	(0.109)	(0.109)	(0.127)	(0.127)
Log(Income Per Capita)	0.373***	0.369***	0.301**	0.300***	0.377***	0.378***	0.305***	0.309***
	(0.105)	(0.103)	(0.113)	(0.110)	(0.104)	(0.104)	(0.113)	(0.112)
Log(Distance) × Year-Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
Year-quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓				
Market FE					✓	✓	✓	✓
Observations	1,209,517	1,209,517	254,999	254,999	1,209,517	1,209,517	254,999	254,999
R-squared	0.835	0.836	0.875	0.876	0.835	0.835	0.875	0.875
Number of market-carrier pairs	45,248	45,248	6,906	6,906	45,248	45,248	6,906	6,906

*** p<0.01, ** p<0.05, * p<0.1

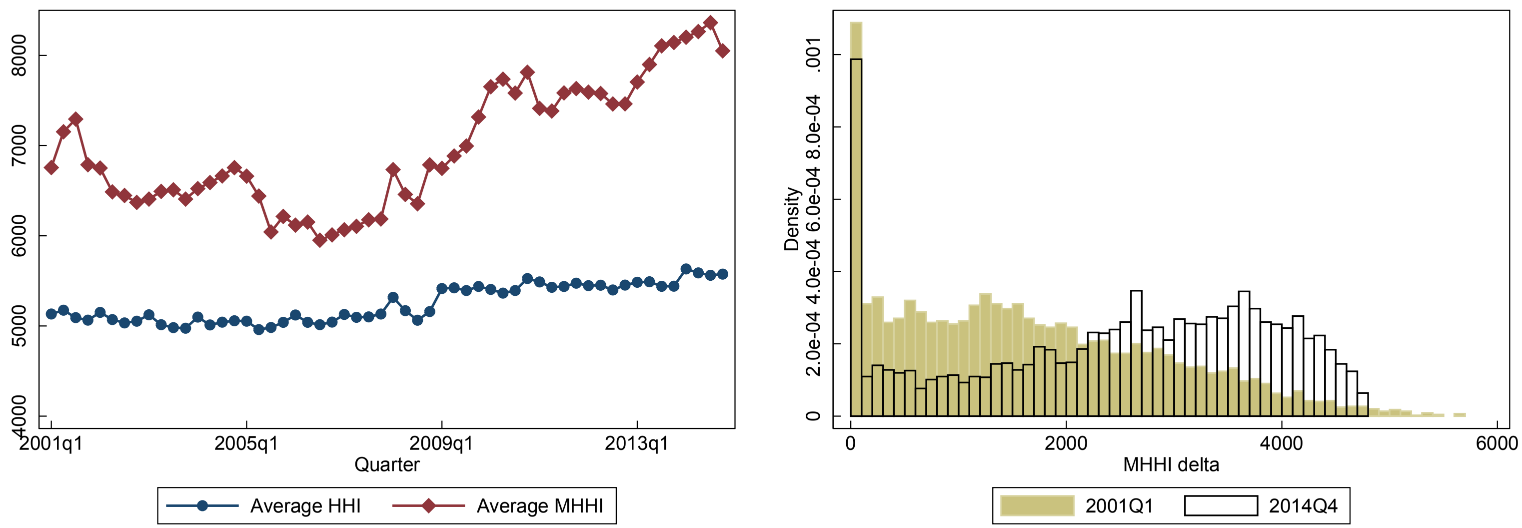

Figure 1: Time-series and cross-sectional variation of common ownership concentration.

The left figure plots the weighted average across routes of HHI and MHHI from 2001Q1 to 2014Q4. The right figure plots the distribution of MHHI delta across markets for 2001Q1 and 2014Q4. HHI is the Herfindahl-Hirschman Index., calculated 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 a modified HHI that takes common ownership into account, and is defined in the appendix. 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 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.

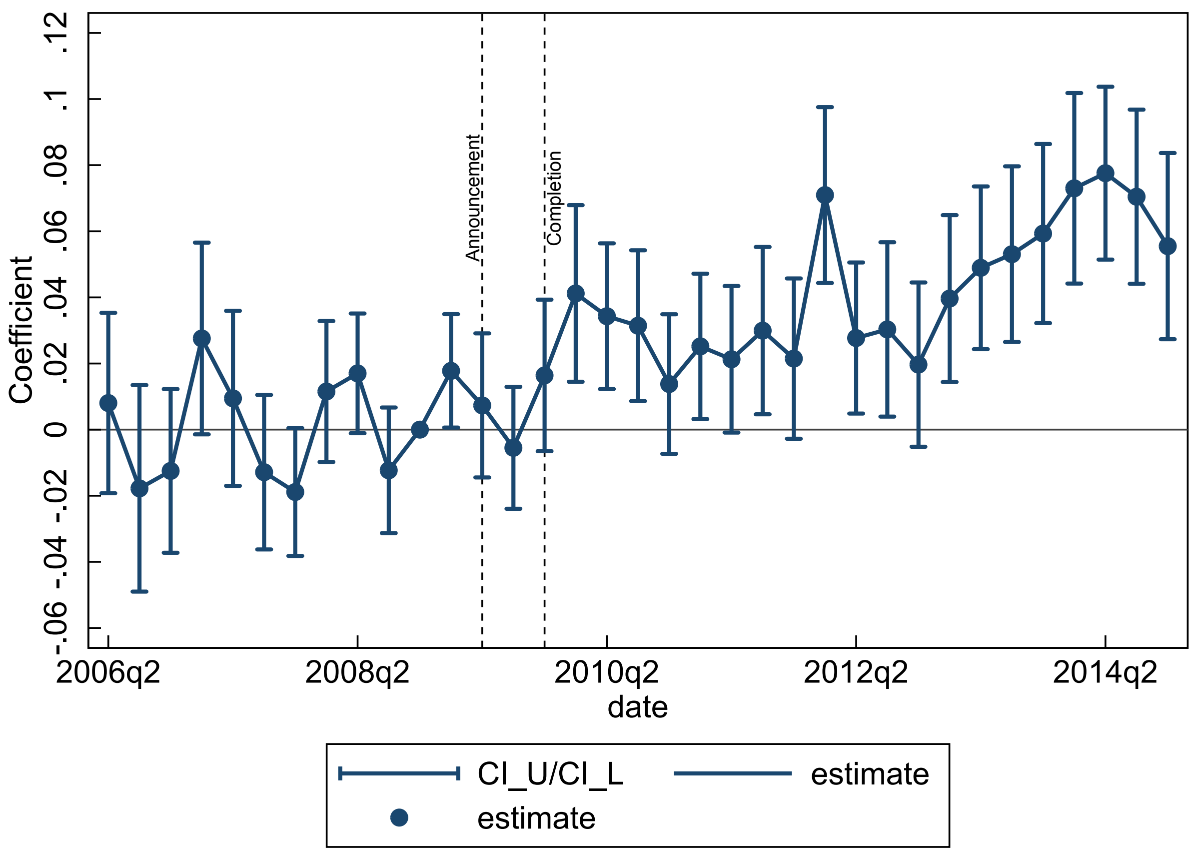

Figure 2: Estimated coefficients of BlackRock-BGI acquisition treatment indicator interacted with year-quarter fixed effects.

The graph plots the estimated coefficient of interactions of the treatment indicator variable with year-quarter fixed effects. We drop the interaction for 2008Q4, so that the effect is normalized to zero for that quarter. We control for the HHI, number of non-stop carriers operating in the route, Southwest indicator, other LCC indicator, log average population in the route endpoints, log average per-capita income in the route endpoints, the share of passengers of the market using connecting flights, the share of passengers in the market using connecting flights, and the log distance of the route, each evaluated in 2009Q1 and interacted with year-quarter fixed effects. We also control for potential confounding events using the implied HHI delta in the route from the DL-NW, UA-CO, AA-US, and FL-WN mergers, the share in the route of AA in 2009Q1, and the change in log per capita income in the route from the start of the Great Recession until 2009Q1, each interacted with year-quarter fixed effects. We weight by average passengers for the market-carrier over time and cluster standard errors two-ways at the market-carrier and year-quarter level.

Internet Appendix (for Online Publication)

A Motivational Theory

The measure of common ownership concentration we employ in our empirical tests, MHHI delta, is a measure of the density of the network of ownership and control between the competitors in a given market, and is an accepted antitrust tool to assess the anticompetitive threats from partial cross-ownership links. Interestingly, however, the same measure can also be derived from a Cournot model of competition in which firms maximize a weighted average of their shareholders' interests. Whereas our empirical analysis does not test this model and does not depend on its assumptions, we provide a brief review to aid with the interpretation of our empirical results and to clarify potential sources of endogeneity. In what follows, we sketch the logic behind O'Brien and Salop (2000)'s version of the MHHI delta.[20]

Suppose an industry or market (indexed r in our empirical analysis; omitted here), has N natural competitors, which are owned by M shareholders. The ownership share of firm j accruing to shareholder i is β_{ij}, and the control share of firm j held by shareholder i is γ_{ij}. Total portfolio profits of shareholder i are given by $\pi^i = \sum_k \beta_{ik}\pi_k$, where π_k are the profits of portfolio firm k. It seems intuitive to assume that managers pay most attention to the goals of their most powerful shareholders. When these shareholders hold stakes in competitors, these goals may include refraining from increasing capacity or starting price wars in markets in which these shareholders hold large ownership interests. By contrast, managers of firms with powerful concentrated shareholders may feel no inhibitions to aggressively pursue a growth strategy at the expense of rivals, even if doing so reduces industry-wide profits. Formally, this intuition can be captured by the following objective function:

$$\max_{x_j} \tilde{\Pi}_j = \sum_{i=1}^{M} \gamma_{ij} \sum_{k=1}^{N} \beta_{ik}\pi_k = \pi_j + \sum_{k \neq j} \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}} \pi_k. \tag{7}$$

In words, firm j maximizes its own profits, plus a linear combination of the profits of other firms in which the shareholders with control hold ownership stakes. Hence, when the

[20] The authors focused on partial ownership acquisitions in competitors (cross-ownership), but their model can be applied to a situation in which the same investors hold shares in natural competitors (common ownership).

manager deliberates strategy, she weighs two effects: the benefits to the own firm on the one hand, and the portfolio losses for diversified shareholders on the other hand, whereas the latter are weighted by how much control these shareholders have in the own firm, and how much they are hurt financially by the action. The assumption does not imply that firms would hurt their own profits just to benefit others. It merely implies that if the portfolio losses to the firms' most powerful shareholders are greater than the gains to the own firm, the action will not find support. Note that this objective nests the standard model in which firms maximize their own profits. Applying this generalized objective function (instead of the special case of own-firm-profit maximization) to a Cournot setting implies the market share-weighted average markup in the market is

$$\eta \sum_j s_j \frac{P - C_j'(x_j)}{P} = \underbrace{\sum_j \sum_k s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}}_{MHHI} = \underbrace{\sum_j s_j^2}_{HHI} + \underbrace{\sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}}}_{MHHIdelta} \tag{8}$$

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), $\sum_j s_j^2$. However, when firms are not separately owned, common ownership concentration, MHHI delta, is part of total market concentration, MHHI. The MHHI delta is a measure of the anticompetitive incentives due to common ownership.

For example, consider two firms that have 50% market share each. The HHI is 5,000 on a scale from 0 (perfect competition) to 10,000 (monopoly). If the firms are separately owned, the MHHI delta is 0 and the MHHI equals the HHI, 5,000. If the two shareholders swap 50% of their shares, they now both receive 50% of the profits from each firm, and thus would want the two firms to act as if they were two divisions of a monopoly. The HHI is still 5,000 because the two firms are still formally independent, but the effective market concentration, reflected by a MHHI of 10,000, is identical to that of a monopoly.

Common ownership concentration as measured by the MHHI delta is a precise measure of the anticompetitive incentives of common ownership if commonly-owned firms compete à la Cournot, just like the HHI is a precise measure of market concentration in a Cournot model when firms are assumed to maximize nothing but their own profits. However, we do not take a literal interpretation of the Cournot model. Instead, we use the MHHI delta as a reduced-form measure of common ownership concentration, similar to any other study that uses HHIs as a reduced-form measure or market concentration.

Note also that the model is static, and does not feature tacit or explicit collusion. It is a model of competition under common ownership, not a model of collusion due to common ownership.[21]

B Data Appendix

This appendix provides details on how we process the data and construct the variables used in the paper.

B.1 Dataset Construction

We construct data on airline prices, passengers, and market shares from the publicly available Department of Transportation's Airline Origin and Destination Survey (DB1B) database. The DB1B database contains a quarterly 10% random sample of domestic airline tickets.

The raw DB1B data are at the ticket level and includes the origin, destination, and price paid for a ticket, as well as how many passengers traveled on that ticket. Each ticket is divided into one or multiple coupons, which represent the flights that are part of the ticket. For example, a one-stop roundtrip ticket has four coupons, two for the outbound itinerary and two for the inbound itinerary. Each coupon has a marketing carrier, the airline that sold the ticket, and an operating carrier, the airline that operated the flight. We exclude tickets with multiple marketing carriers from the analysis. For all remaining tickets, we treat the marketing carrier as the airline that sets the price for the ticket, and thus assign the price and passengers of the ticket to the marketing carrier. The main reason for using the marketing carrier, rather than the operating carrier, as the competitively significant carrier is that in the data available to us, the operating carrier is frequently a regional affiliate of a

[21] Collusion under common ownership is studied e.g. by Gilo, Moshe, and Spiegel (2006); de Haas and Paha (2016). These authors show that common ownership can make sustained collusion harder or easier, depending on the mode of competition and various other assumptions. For example, when common ownership and therefore the unilateral effects to reduce capacity or increase prices are already high, the *additional* price effect from collusion can become increasingly hard to realize.

major airline that does not directly compete for passengers.

We further exclude tickets from the data that cannot be unambiguously assigned to a market, that is, an origin-destination pair. In particular, 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, that is, a part of the itinerary to which the plane does not travel, and (3) tickets on which the origin or destination are also visited as intermediary airports.

We treat roundtrip tickets as comparable to one-way tickets by splitting them into the inbound and the outbound itinerary, and considering each itinerary as a separate one-way ticket. The price for roundtrip tickets is 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 because they are not competing for regularly scheduled service on US routes.

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 it tickets 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 it performed at least 60 flights in each direction during the quarter. We count Southwest and other low-cost carriers as serving a market nonstop if it performs at least 24 flights per quarter in each direction.

To construct institutional common ownership variables, we use data on institutional holdings from the Thomson-Reuters Spectrum data set on 13F filings. This data set includes institutional holdings for all firms publicly traded in US stock markets. The Thomson-Reuters data identify managers by SEC filing, assigning them a manager number. Some institutions are assigned more than one manager number. In these cases, we deviate from the manager numbers assigned by Thomson Reuters and assign the same identifier to all occurrences of an institution, based on the institution name. The Thompson Reuters data include data on voting shares separately, allowing us to construct for each fund manager and each airline 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. Holdings are further 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.

We also include institutional owners from SEC proxy statements that are not present in the Thomson data if they hold 5% or more of outstanding shares in any company in our sample. We add owners from the SEC filings to our data only for the year of the corresponding shareholder meeting.

B.2 Variable Definitions

The resulting data sets, together with additional data sources described below, are used to construct the following variables:

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

- HHI (Herfindahl-Hirschman Index): We calculate the index as the sum of passenger shares squared, for a given route and quarter. As mentioned in the data description above, we exclude non-US and charter airlines in the calculation of the passenger shares.

- 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 passenger 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: This variable is the difference between the MHHI and the HHI, which is a measure of common ownership of airlines in a route.

- Number of non-stop carriers: We define a carrier to be operating nonstop in a market in a quarter if it performs at least 60 nonstop flights each way in the quarter, according to the T100 database. We then count the number of carriers on the route and quarter as the number of marketing carriers that are associated with a nonstop operating carrier on the route. We do not count carriers that are excluded in the HHI calculation.

- Southwest indicator: This is a dummy variable that is equal to one if Southwest operates at least 24 nonstop flights in each direction in a market and quarter, and zero otherwise.
- Other LCC indicator: This is a dummy variable that is equal to one if an LCC other than Southwest operates at least 24 nonstop flights in each direction in a market and 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: We measure the population in a market and quarter as the geometric mean of endpoint populations in millions. Data on MSA populations come from the Bureau of Economic Analysis.
- Income per capita: We measure income per capita in a market and quarter as the geometric mean of endpoint incomes per capita (in thousands, 2008 dollars). Data on MSA income per capita come from the Bureau of Economic Analysis.
- Share of passengers traveling connect, market level: This variable is the fraction of passengers in a market and quarter that use connecting flights.
- Share of passengers traveling connect: This variable is the fraction of passengers of a given carrier in a market and quarter that use connecting flights.
- Fraction institutional ownership: This variable is the fraction of shares held by institutional investors according to the Thomson 13F database.
- Institutional ownership concentration: This variable is the 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 five institutional holdings as Fraction of all institutional holdings: This variable is measured as the holdings of the top five institutional shareholders in a given firm as a percentage of all institutional holdings, according to the Thomson 13F database.
- Carrier-Route-Level Common Ownership (CRCO): We define common ownership at the carrier-route level as the market-share-weighted average of the weight that the

carrier places on the profits of other carriers in the route relative to its own profits. CRCO for carrier j in route r in year-quarter t is $CRCO_{jrt} = \sum_{k \neq j} \frac{\sum_i \gamma_{ij,t}\beta_{ik,t}}{\sum_i \gamma_{ij,t}\beta_{ij,t}} \frac{s_{k,rt}}{1-s_{j,rt}}$.

- Carrier-level MHHI delta: This is a measure of common ownership for a given carrier at a given year-quarter. We define the carrier level MHHI delta as the average MHHI delta for a given carrier and year-quarter across all markets in which the carrier is present.

- Average of carrier-level MHHI delta of competitors: We define this as the average carrier-level MHHI delta for the carriers in a route at a given point in time, excluding the carrier of the observation.

- Churn ratio: We define a shareholder i's churn ratio at time t, following Gaspar, Massa, and Matos (2005), as $CR_{it} = \frac{\sum_{j \in Q} |N_{jit}P_{jt} - N_{ji,t-1}P_{j,t-1} - N_{ji,t-1}\Delta P_{j,t}|}{\sum_{j \in Q} \frac{N_{jit}P_{jt} + N_{ji,t-1}P_{j,t-1}}{2}}$, where Q denotes the set of companies held by investor i, N_{jit} represents the number of shares in firm j held by shareholder i, and P_{jt}represents the price of firm j at time t. We calculate the churn ratio of each shareholder at each point in time using all firms, not just airlines.

- Average route contact: We measure multi-market contact in route r as average route contact, following Evans and Kessides (1994): $MMC_r = \frac{1}{N_r(1-N_r)/2} \sum_j \sum_{k>j} a_{jk} D_{jr} D_{kr}$, where N_r is the number of airlines operating in route r, D_{jr} is a dummy variable equal to 1 if carrier j operates in route r, and a_{jk} is the number of routes in which both carriers are active with a market share of at least 1%.

C Appendix Tables and Figures

Table C.1: Effect of Common Ownership on Airline Ticket Prices: IV Regressions Using Continuous Treatment, First Stage.

Common ownership is measured as MHHI delta. 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. We use the resulting implied change in MHHI delta as a continuous treatment variable. We exclude markets with less than 20 passengers per day on average. We exclude market carriers with any missing observations during the period 2006Q2-2014Q4. We weight by passengers the market carrier in 2009Q1. Standard errors are robust to heteroskedasticity. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Change in MHHI delta 2009Q1-Post					
Post-period:	2010Q1 (1)	2011Q1 (2)	2012Q1 (3)	2013Q1 (4)	2014Q1 (5)	2010-2014 Q1 (6)
Implied Change in MHHI delta	6.416***	3.104***	5.379***	4.101***	5.161***	4.832***
	(0.360)	(0.450)	(0.477)	(0.472)	(0.667)	(0.432)
HHI_{2009Q1}	-0.0246*	-0.0498***	-0.0204	-0.0570***	-0.0881***	-0.0480***
	(0.0145)	(0.0181)	(0.0187)	(0.0203)	(0.0258)	(0.0178)
Number of Nonstop $Carriers_{2009Q1}$	-0.00272	-0.000707	-0.00459*	-0.00483*	-0.00444	-0.00346
	(0.00175)	(0.00223)	(0.00243)	(0.00257)	(0.00314)	(0.00225)
Southwest $Indicator_{2009Q1}$	-0.0111**	-0.00974*	-0.0244***	-0.0165***	-0.0320***	-0.0188***
	(0.00450)	(0.00552)	(0.00587)	(0.00586)	(0.00764)	(0.00527)
Other LCC $Indicator_{2009Q1}$	-0.00999*	-0.0242***	-0.00743	-0.00949	-0.0266***	-0.0155**
	(0.00514)	(0.00640)	(0.00682)	(0.00686)	(0.00865)	(0.00605)
Share of Passengers Traveling $Connect_{2009Q1}$	-0.00486	-0.000352	0.000565	0.00504	0.00237	0.000555
	(0.00456)	(0.00536)	(0.00581)	(0.00595)	(0.00814)	(0.00529)
Share of Passengers Traveling Connect, $Market\text{-}Level_{2009Q1}$	0.0206*	0.0143	0.00903	-0.00519	-0.0313*	0.00150
	(0.0113)	(0.0136)	(0.0146)	(0.0150)	(0.0184)	(0.0132)
Log $(Population)_{2009Q1}$	0.00257	0.00384	0.0116***	0.00895**	0.0142***	0.00823***
	(0.00277)	(0.00336)	(0.00346)	(0.00362)	(0.00451)	(0.00319)
Log (Income Per $Capita)_{2009Q1}$	-0.0415**	-0.00642	-0.0177	0.0141	-0.00952	-0.0122
	(0.0204)	(0.0240)	(0.0245)	(0.0269)	(0.0324)	(0.0236)
Log $(Distance)_{2009Q1}$	0.00175	0.00288	-0.00624	0.00470	0.00822	0.00226
	(0.00353)	(0.00400)	(0.00418)	(0.00450)	(0.00574)	(0.00399)
Share DL × Share NW in 2008Q4	0.389***	0.410***	0.674***	0.537***	0.995***	0.601***
	(0.106)	(0.116)	(0.143)	(0.125)	(0.150)	(0.118)
Share UA × Share CO in 2009Q1	0.677***	-0.835***	-0.366**	-0.464***	-0.430***	-0.284**
	(0.0962)	(0.100)	(0.166)	(0.136)	(0.163)	(0.115)
Share AA × Share US in 2009Q1	-0.748***	-0.918***	-0.797***	-0.610***	-1.393***	-0.893***
	(0.0536)	(0.0887)	(0.0717)	(0.0775)	(0.122)	(0.0644)
Share FL × Share WN in 2009Q1	-0.219**	-0.247**	-0.905***	-0.745***	-0.682***	-0.560***
	(0.102)	(0.105)	(0.118)	(0.0989)	(0.134)	(0.0956)
Share AA in 2009Q1	0.0211***	0.0512***	0.0284***	0.0316**	0.0424***	0.0349***
	(0.00716)	(0.0102)	(0.00986)	(0.0128)	(0.0162)	(0.00920)
Percent Change in Income during Great Recession	0.219***	0.197***	0.233***	0.350***	0.314***	0.263***
	(0.0615)	(0.0730)	(0.0758)	(0.0861)	(0.113)	(0.0743)
Constant	0.190***	0.0704	0.160**	0.0143	0.126	0.112
	(0.0642)	(0.0777)	(0.0813)	(0.0918)	(0.114)	(0.0767)
Observations	5,022	5,022	5,022	5,022	5,022	5,022
F-stat (Weak Identification Test)	316.9	47.58	127.4	75.54	59.82	125

*** p<0.01, ** p<0.05, * p<0.1

Table C.2: Effect of Common Ownership on Airline Ticket Prices: IV Regressions Using Discrete Treatment, First Stage.

Common ownership is measured as MHHI delta. 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. We exclude markets with less than 20 passengers per day on average. We exclude market carriers with any missing observations during the period 2006Q2-2014Q4. We weight by passengers the market carrier in 2009Q1. Standard errors are robust to heteroskedasticity. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Change in MHHI delta 2009Q1-Post					
Post-period:	2010Q1 (1)	2011Q1 (2)	2012Q1 (3)	2013Q1 (4)	2014Q1 (5)	2010-2014 Q1 (6)
Treatment (Discrete)	0.0871***	0.0492***	0.0716***	0.0534***	0.0681***	0.0659***
	(0.00511)	(0.00642)	(0.00661)	(0.00639)	(0.00904)	(0.00599)
HHI_{2009Q1}	-0.0365***	-0.0455***	-0.0324*	-0.0678***	-0.101***	-0.0565***
	(0.0140)	(0.0171)	(0.0179)	(0.0194)	(0.0247)	(0.0170)
Number of Nonstop $Carriers_{2009Q1}$	-0.00386**	-0.000572	-0.00569**	-0.00577**	-0.00555*	-0.00429*
	(0.00172)	(0.00217)	(0.00238)	(0.00252)	(0.00306)	(0.00219)
Southwest $Indicator_{2009Q1}$	-0.0159***	-0.0102*	-0.0288***	-0.0201***	-0.0364***	-0.0223***
	(0.00455)	(0.00543)	(0.00584)	(0.00580)	(0.00754)	(0.00524)
Other LCC $Indicator_{2009Q1}$	-0.00748	-0.0221***	-0.00552	-0.00819	-0.0249***	-0.0136**
	(0.00521)	(0.00635)	(0.00680)	(0.00683)	(0.00861)	(0.00602)
Share of Passengers Traveling $Connect_{2009Q1}$	-0.00655	-0.00128	-0.000832	0.00400	0.00104	-0.000725
	(0.00472)	(0.00546)	(0.00592)	(0.00603)	(0.00821)	(0.00539)
Share of Passengers Traveling Connect, $Market\text{-}Level_{2009Q1}$	0.0209*	0.0167	0.00876	-0.00577	-0.0318*	0.00177
	(0.0113)	(0.0133)	(0.0144)	(0.0149)	(0.0182)	(0.0130)
Log $(Population)_{2009Q1}$	0.00378	0.00413	0.0126***	0.00981***	0.0153***	0.00913***
	(0.00285)	(0.00335)	(0.00347)	(0.00362)	(0.00447)	(0.00319)
Log $(Income\ Per\ Capita)_{2009Q1}$	-0.0510**	-0.00835	-0.0262	0.00720	-0.0179	-0.0192
	(0.0211)	(0.0244)	(0.0250)	(0.0274)	(0.0329)	(0.0242)
Log $(Distance)_{2009Q1}$	0.00390	0.00455	-0.00456	0.00588	0.00977*	0.00391
	(0.00362)	(0.00403)	(0.00421)	(0.00452)	(0.00576)	(0.00403)
Share DL × Share NW in 2008Q4	0.342***	0.359***	0.640***	0.516***	0.965***	0.565***
	(0.109)	(0.117)	(0.142)	(0.127)	(0.149)	(0.118)
Share UA × Share CO in 2009Q1	0.644***	-0.828***	-0.398**	-0.492***	-0.463***	-0.308***
	(0.0930)	(0.101)	(0.174)	(0.140)	(0.164)	(0.119)
Share AA × Share US in 2009Q1	-0.758***	-0.948***	-0.801***	-0.608***	-1.394***	-0.902***
	(0.0555)	(0.0863)	(0.0709)	(0.0759)	(0.128)	(0.0651)
Share FL × Share WN in 2009Q1	-0.134*	-0.234**	-0.828***	-0.682***	-0.606***	-0.497***
	(0.0784)	(0.0911)	(0.0929)	(0.0926)	(0.116)	(0.0754)
Share AA in 2009Q1	0.0218***	0.0554***	0.0282***	0.0309**	0.0419**	0.0356***
	(0.00753)	(0.0103)	(0.00998)	(0.0128)	(0.0163)	(0.00943)
Percent Change in Income during Great Recession	0.212***	0.195***	0.228***	0.345***	0.309***	0.258***
	(0.0623)	(0.0732)	(0.0764)	(0.0861)	(0.113)	(0.0745)
Constant	0.230***	0.0641	0.199**	0.0483	0.165	0.141*
	(0.0676)	(0.0792)	(0.0829)	(0.0930)	(0.115)	(0.0786)
Observations	5,022	5,022	5,022	5,022	5,022	5,022
F-stat (Weak Identification Test)	290.4	58.88	117.3	69.79	56.78	121

*** p<0.01, ** p<0.05, * p<0.1

Table C.2: (continued). Effect of Common Ownership on Airline Ticket Prices: IV Regressions Using Discrete Treatment: Second Stage.

Common ownership is measured as MHHI delta. 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. We exclude markets with less than 20 passengers per day on average. We exclude market carriers with any missing observations during the period 2006Q2-2014Q4. We weight by passengers the market carrier in 2009Q1. Standard errors are robust to heteroskedasticity. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Change in Log(Average Fare) 2009Q1-Post					
Post-period:	2010Q1 (1)	2011Q1 (2)	2012Q1 (3)	2013Q1 (4)	2014Q1 (5)	2010-2014 Q1 (6)
Change in MHHI delta 2009Q1-Post	0.142	0.199	0.765***	0.357	0.824***	0.462**
	(0.151)	(0.275)	(0.196)	(0.279)	(0.234)	(0.186)
HHI_{2009Q1}	0.0190	0.0299	0.00243	0.0455	0.0724	0.0308
	(0.0344)	(0.0452)	(0.0435)	(0.0502)	(0.0596)	(0.0389)
Number of Nonstop $Carriers_{2009Q1}$	0.00960**	0.0127**	0.00659	0.0172***	0.0131*	0.0115**
	(0.00471)	(0.00602)	(0.00616)	(0.00574)	(0.00683)	(0.00526)
Southwest $Indicator_{2009Q1}$	0.0238*	0.0461***	0.0550***	0.0852***	0.0853***	0.0567***
	(0.0135)	(0.0145)	(0.0155)	(0.0164)	(0.0198)	(0.0136)
Other LCC $Indicator_{2009Q1}$	-0.0184	-0.0400**	-0.0237	-0.0184	-0.0167	-0.0238*
	(0.0140)	(0.0158)	(0.0157)	(0.0168)	(0.0182)	(0.0138)
Share of Passengers Traveling $Connect_{2009Q1}$	0.0312***	0.0648***	0.0324**	0.0236*	0.0334**	0.0375***
	(0.0105)	(0.0125)	(0.0127)	(0.0140)	(0.0156)	(0.0107)
Share of Passengers Traveling Connect, Market-$Level_{2009Q1}$	-0.0445*	-0.00519	-0.0103	0.144***	0.0747**	0.0279
	(0.0243)	(0.0305)	(0.0318)	(0.0312)	(0.0375)	(0.0261)
Log $(Population)_{2009Q1}$	-0.0108	0.00504	-0.0208*	-0.000446	0.000798	-0.00403
	(0.00887)	(0.00975)	(0.0107)	(0.0101)	(0.0112)	(0.00889)
Log (Income Per $Capita)_{2009Q1}$	-0.0705*	0.0409	0.0298	0.128***	-0.00672	0.0250
	(0.0401)	(0.0417)	(0.0488)	(0.0496)	(0.0545)	(0.0378)
Log $(Distance)_{2009Q1}$	-0.00791	-0.0321***	-0.0376***	-0.0448***	-0.0674***	-0.0381***
	(0.00726)	(0.00768)	(0.00843)	(0.00809)	(0.00911)	(0.00660)
Share DL × Share NW in 2008Q4	0.234	0.256	0.561**	0.730**	0.550	0.523**
	(0.236)	(0.234)	(0.267)	(0.301)	(0.403)	(0.236)
Share UA × Share CO in 2009Q1	0.138	0.976***	1.134***	1.605***	1.623***	1.050***
	(0.195)	(0.352)	(0.368)	(0.420)	(0.372)	(0.251)
Share AA × Share US in 2009Q1	0.414**	0.294	0.793***	0.807***	1.144***	0.652***
	(0.172)	(0.309)	(0.291)	(0.262)	(0.376)	(0.230)
Share FL × Share WN in 2009Q1	-0.0368	0.220	1.266***	0.797**	1.190***	0.628***
	(0.223)	(0.231)	(0.292)	(0.310)	(0.331)	(0.242)
Share AA in 2009Q1	-0.0100	0.00531	-0.00954	-0.0195	0.00750	-0.00545
	(0.0211)	(0.0241)	(0.0260)	(0.0252)	(0.0259)	(0.0204)
Percent Change in Income during Great Recession	-0.123	0.0935	0.0366	-0.329	-0.246	-0.109
	(0.144)	(0.162)	(0.189)	(0.205)	(0.205)	(0.151)
Constant	0.346**	0.127	0.254	-0.186	0.470**	0.207
	(0.162)	(0.163)	(0.189)	(0.191)	(0.218)	(0.151)
Observations	5,022	5,022	5,022	5,022	5,022	5,022
R-squared	0.044	0.089	0.076	0.112	0.044	0.103

*** p<0.01, ** p<0.05, * p<0.1

Table C.3: Effect of Common Ownership on Airline Ticket Prices for Market-Carriers and Markets Affected and Unaffected by Major Bankruptcy Events: Panel Regressions.

We count as major bankruptcy events the bankruptcies of United Airlines, Delta, American Airlines, US Airways, Northwest, and Mesa Airlines. Common ownership is measured as MHHI delta. Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare)					
	Market-carrier level				Market-level	
	Bankrupt Carriers (1)	Non-Bankrupt Carriers (2)	Bankruptcy Markets (3)	Non-Bankrutpcy Markets (4)	Bankruptcy Markets (5)	Non-Bankrutpcy Markets (6)
MHHI delta	0.0383	0.156***	0.134***	0.177***	0.188***	0.252***
	(0.0711)	(0.0404)	(0.0350)	(0.0578)	(0.0412)	(0.0488)
HHI	0.0473	0.150***	0.143***	0.187***	0.231***	0.289***
	(0.0615)	(0.0226)	(0.0340)	(0.0252)	(0.0372)	(0.0273)
Number of Nonstop Carriers	-0.0104	-0.00978***	-0.00344	-0.0139***	0.000230	-0.0137***
	(0.00622)	(0.00276)	(0.00343)	(0.00374)	(0.00456)	(0.00491)
Southwest Indicator	-0.127***	-0.116***	-0.107***	-0.123***	-0.138***	-0.149***
	(0.0381)	(0.00921)	(0.0120)	(0.0112)	(0.0156)	(0.0152)
Other LCC Indicator	-0.0637***	-0.0585***	-0.0599***	-0.0524***	-0.0931***	-0.0924***
	(0.0193)	(0.00724)	(0.0107)	(0.00775)	(0.0122)	(0.0114)
Share of Passengers Traveling Connect, Market-Level	0.143**	0.118***	0.196***	0.0919***	0.195***	0.141***
	(0.0572)	(0.0163)	(0.0254)	(0.0188)	(0.0279)	(0.0222)
Share of Passengers Traveling Connect	0.189***	0.103***	0.0867***	0.0979***		
	(0.0255)	(0.0149)	(0.0179)	(0.0172)		
Log(Population)	0.248	0.305***	0.160	0.379***	0.175	0.463***
	(0.427)	(0.112)	(0.137)	(0.109)	(0.147)	(0.126)
Log(Income Per Capita)	0.150	0.414***	-0.0627	0.459***	-0.0839	0.408***
	(0.260)	(0.106)	(0.133)	(0.109)	(0.137)	(0.125)
Log(Distance) × Year-Quarter FE	✓	✓	✓	✓	✓	✓
Year-quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓		
Market FE					✓	✓
Observations	139,003	1,068,300	532,420	673,198	98,429	156,124
R-squared	0.814	0.847	0.835	0.858	0.882	0.889
Number of market-carrier pairs	18,585	44,746	36,962	41,298		
Number of markets					5,615	6,665

*** p<0.01, ** p<0.05, * p<0.1

Table C.4: Effect of Common Ownership on Airline Market Passenger Volume.

Common ownership is measured as MHHI delta. Data are for the period 2001Q1-2014Q4. We exclude routes with less than 20 passengers per day on average. We weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Market Passengers)		
	(1)	(2)	(3)
MHHI delta	-0.665***	-0.607***	-0.213***
	(0.0876)	(0.0824)	(0.0527)
HHI	-0.519***	-0.496***	-0.583***
	(0.0662)	(0.0660)	(0.0443)
Number of Nonstop Carriers			0.00575
			(0.00474)
Southwest Indicator			0.258***
			(0.0211)
Other LCC Indicator			0.191***
			(0.0143)
Share of Passengers Traveling Connect, Market-Level			-1.369***
			(0.0502)
Log(Population)			0.674***
			(0.181)
Log(Income Per Capita)			0.663***
			(0.193)
Log(Distance) × Year-Quarter FE		✓	✓
Year-Quarter FE	✓	✓	✓
Market FE	✓	✓	✓
Observations	262,350	262,350	254,999
R-squared	0.946	0.950	0.965
Number of markets	7,185	7,185	6,906

*** p<0.01, ** p<0.05, * p<0.1

Table C.5: Effect of Common Ownership on Airline Ticket Prices: Using Only Largest 10, 5, 3, and 1 Shareholders.

Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. We calculate the MHHI delta setting the control rights to zero for shareholders other than the largest 10, largest 5, largest 3, and largest shareholder for each market-carrier and date. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare)							
	Market-carrier level				Market-level			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MHHI delta (Top 10 Shareholders)	0.149***				0.198***			
	(0.0373)				(0.0352)			
MHHI delta (Top 5 Shareholders)		0.136***				0.173***		
		(0.0368)				(0.0340)		
MHHI delta (Top 3 Shareholders)			0.114***				0.145***	
			(0.0333)				(0.0310)	
MHHI delta (Top 1 Shareholder)				0.0717***				0.0889***
				(0.0220)				(0.0198)
HHI	0.163***	0.158***	0.153***	0.141***	0.251***	0.244***	0.237***	0.220***
	(0.0206)	(0.0206)	(0.0202)	(0.0186)	(0.0242)	(0.0240)	(0.0238)	(0.0222)
Number of Nonstop Carriers	-0.00980***	-0.00967***	-0.00967***	-0.00992***	-0.00811**	-0.00796**	-0.00800**	-0.00837**
	(0.00269)	(0.00267)	(0.00266)	(0.00267)	(0.00371)	(0.00368)	(0.00367)	(0.00369)
Southwest Indicator	-0.120***	-0.120***	-0.120***	-0.120***	-0.149***	-0.149***	-0.149***	-0.149***
	(0.00928)	(0.00927)	(0.00933)	(0.00936)	(0.0135)	(0.0135)	(0.0136)	(0.0137)
Other LCC Indicator	-0.0620***	-0.0627***	-0.0634***	-0.0648***	-0.101***	-0.102***	-0.103***	-0.105***
	(0.00717)	(0.00717)	(0.00725)	(0.00730)	(0.00988)	(0.00990)	(0.00998)	(0.0100)
Share of Passengers Traveling Connect, Market-Level	0.124***	0.124***	0.125***	0.127***	0.158***	0.158***	0.159***	0.160***
	(0.0167)	(0.0167)	(0.0166)	(0.0165)	(0.0189)	(0.0189)	(0.0189)	(0.0189)
Share of Passengers Traveling Connect	0.0987***	0.0984***	0.0979***	0.0970***				
	(0.0143)	(0.0143)	(0.0143)	(0.0143)				
Log(Population)	0.304***	0.302***	0.304***	0.303***	0.341***	0.339***	0.341***	0.339***
	(0.106)	(0.106)	(0.105)	(0.106)	(0.122)	(0.122)	(0.122)	(0.123)
Log(Income Per Capita)	0.370***	0.367***	0.368***	0.368***	0.299***	0.296***	0.298***	0.298***
	(0.102)	(0.101)	(0.102)	(0.102)	(0.110)	(0.110)	(0.110)	(0.110)
Log(Distance) × Year-Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
Year-quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓				
Market FE					✓	✓	✓	✓
Observations	1,209,517	1,209,517	1,209,517	1,209,517	254,999	254,999	254,999	254,999
R-squared	0.836	0.836	0.836	0.836	0.876	0.876	0.876	0.876
Number of market-carrier pairs	45,248	45,248	45,248	45,248				
Number of markets					6,906	6,906	6,906	6,906

*** p<0.01, ** p<0.05, * p<0.1

Table C.6: Effect of Common Ownership on Airline Ticket Prices: MHHI delta Using Only Shareholders Ranked Below Top 10 (Placebo).

Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. We calculate the MHHI delta setting the control rights to zero for shareholders ranked 1-10 for each market-carrier and date. Variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare)	
	Market-carrier level	Market-level
	(1)	(2)
MHHI delta (Shareholders Ranked Below Top 10)	-0.0436	-0.0312
	(0.0314)	(0.0275)
HHI	0.105***	0.184***
	(0.0243)	(0.0256)
Number of Nonstop Carriers	-0.0101***	-0.00859**
	(0.00270)	(0.00377)
Southwest Indicator	-0.116***	-0.145***
	(0.00941)	(0.0137)
Other LCC Indicator	-0.0698***	-0.111***
	(0.00779)	(0.0105)
Share of Passengers Traveling Connect, Market-Level	0.135***	0.166***
	(0.0164)	(0.0189)
Share of Passengers Traveling Connect	0.0948***	
	(0.0144)	
Log(Population)	0.298***	0.331**
	(0.111)	(0.128)
Log(Income Per Capita)	0.379***	0.307***
	(0.104)	(0.112)
Log(Distance) × Year-Quarter FE	✓	✓
Year-quarter FE	✓	✓
Market-Carrier FE	✓	
Market FE		✓
Observations	1,209,517	254,999
R-squared	0.836	0.875
Number of market-carrier pairs	45,248	
Number of markets		6,906

*** p<0.01, ** p<0.05, * p<0.1

Table C.7: Effect of Carrier-Level Common Ownership on Airline Ticket Prices: Panel Regressions.

Common ownership is measured as MHHI delta. Carrier-level MHHI delta is the average MHHI delta for a given carrier and year-quarter across all markets in which the carrier is present. Average of carrier-level MHHI delta of competitors is the average carrier-level MHHI delta for the carriers in the route, excluding the carrier of the observation. Data are for the period 2001Q1-2014Q4. 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 two-ways at the market-carrier and year-quarter level. For the market-level regressions, we weight by average passengers in the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta is the increase in concentration solely due to common ownership. Other variable definitions are provided in the appendix. While throughout the paper the HHI and MHHI are expressed on a scale of 0 to 10,000, we use a scale of 0 to 1 for the regressions.

	Dependent Variable: Log(Average Fare) Market-carrier level					
	(1)	(2)	(3)	(4)	(5)	(6)
Carrier-Level MHHI delta	0.983***	0.910***	0.996***			
	(0.205)	(0.185)	(0.184)			
Average Carrier-Level MHHI delta of Competitors				0.0740	0.172	0.0576
				(0.153)	(0.151)	(0.160)
MHHI delta	0.140***	0.172***	0.0947***	0.199***	0.212***	0.140***
	(0.0425)	(0.0374)	(0.0337)	(0.0460)	(0.0394)	(0.0385)
HHI	0.215***	0.225***	0.160***	0.219***	0.227***	0.164***
	(0.0241)	(0.0242)	(0.0200)	(0.0250)	(0.0247)	(0.0210)
Number of Nonstop Carriers			-0.00962***			-0.00959***
			(0.00277)			(0.00270)
Southwest Indicator			-0.120***			-0.120***
			(0.00922)			(0.00933)
Other LCC Indicator			-0.0633***			-0.0621***
			(0.00742)			(0.00730)
Share of Passengers Traveling Connect, Market-Level			0.128***			0.125***
			(0.0167)			(0.0168)
Share of Passengers Traveling Connect			0.0987***			0.102***
			(0.0141)			(0.0140)
Log(Population)			0.308***			0.288**
			(0.103)			(0.110)
Log(Income Per Capita)			0.350***			0.338***
			(0.0963)			(0.109)
Log(Distance) × Year-Quarter FE		✓	✓		✓	✓
Year-quarter FE	✓	✓	✓	✓	✓	✓
Market-Carrier FE	✓	✓	✓	✓	✓	✓
Observations	1,237,584	1,237,584	1,209,517	1,225,170	1,225,170	1,198,782
R-squared	0.821	0.826	0.837	0.813	0.818	0.830
Number of market-carrier pairs	46,513	46,513	45,248	46,048	46,048	44,860

*** p<0.01, ** p<0.05, * p<0.1

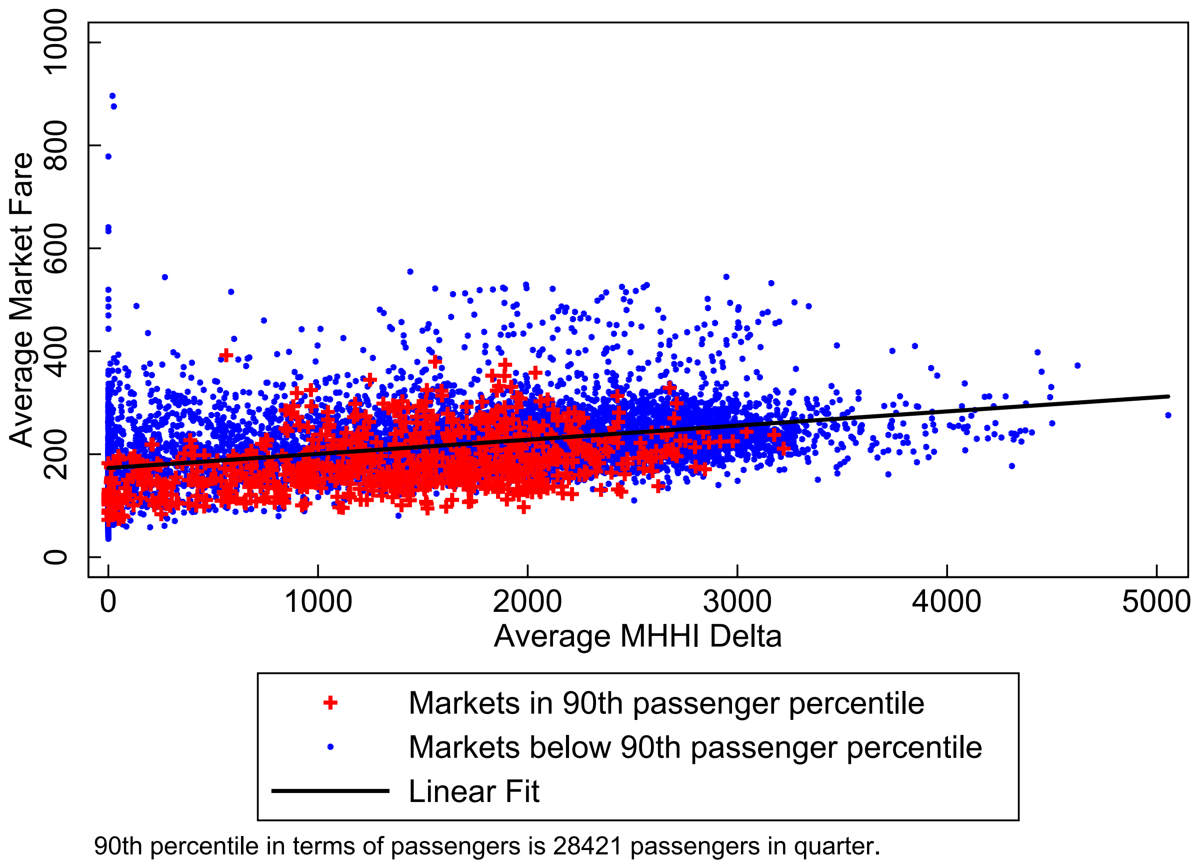

Figure C.1: Raw correlation between average airfares and average MHHI delta at the market level, averages using data from 2001Q1 to 2014Q4.

The graph illustrates the raw cross-sectional correlation between airfares and MHHI delta. The MHHI delta, which is a measure of common ownership 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.

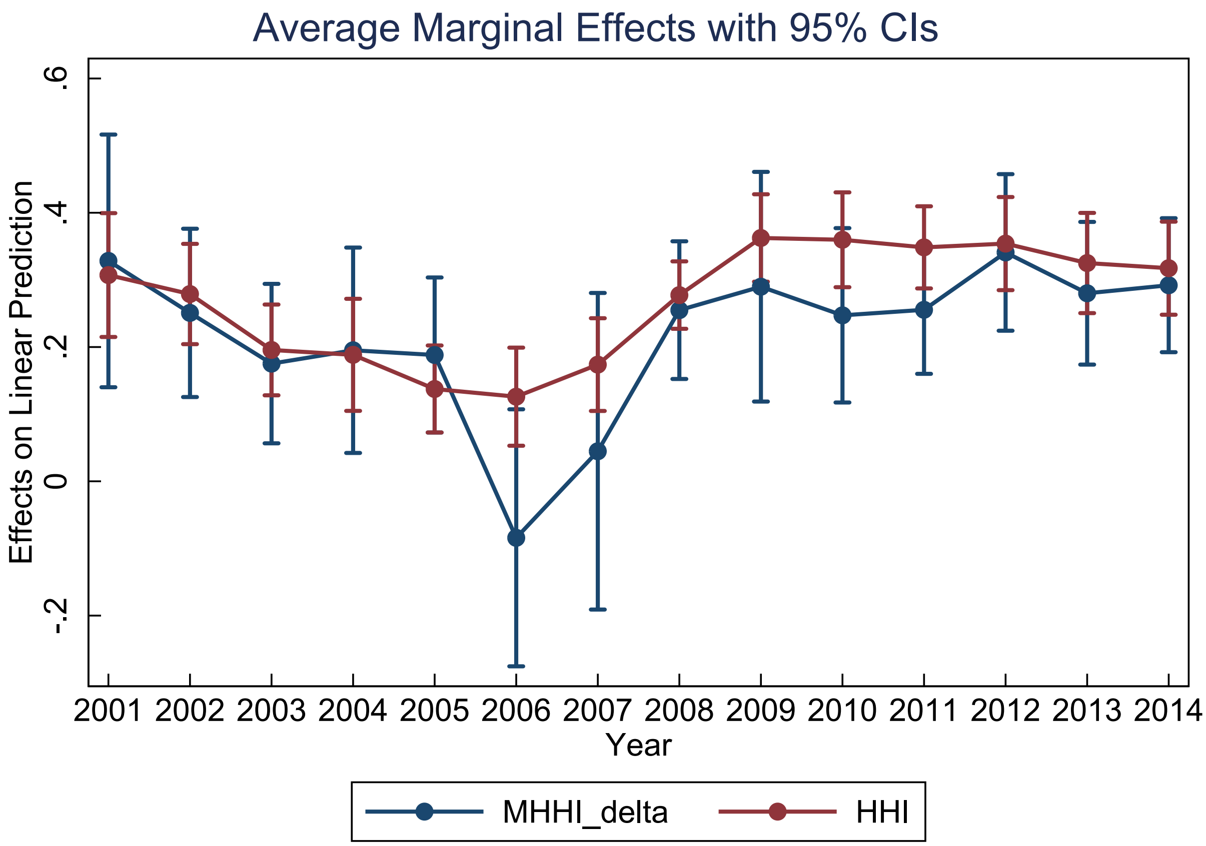

Figure C.2: Estimated effect of HHI and MHHI delta on ticket prices, by year.
It is derived from a market-level regression of prices based on Table 2 specification (6), but with the MHHI delta and the HHI each interacted with year fixed effects. We weight by average passengers for the market over time and cluster standard errors two-ways at the market and year-quarter level. The MHHI delta, which is a measure of common ownership 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.

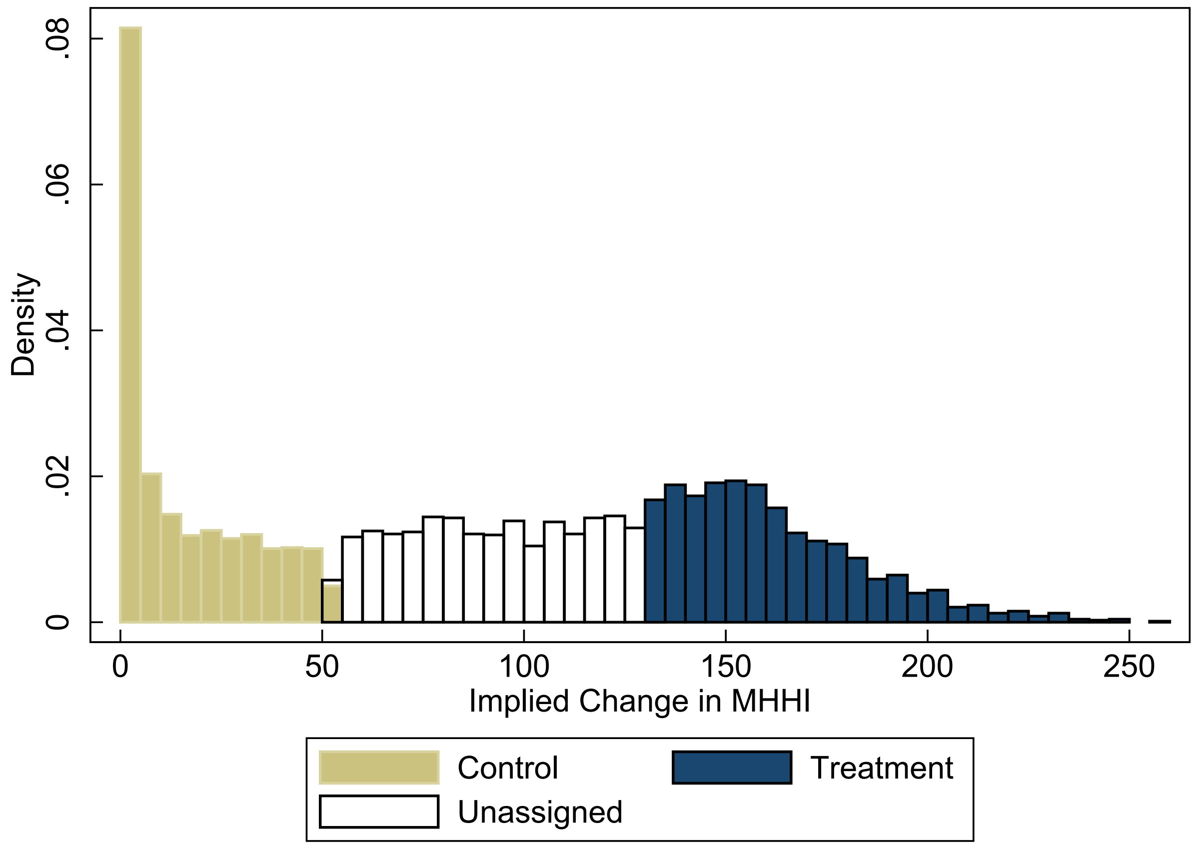

Figure C.3: Distribution of implied MHHI delta across markets (BlackRock-BGI DiD) .
The implied MHHI delta reflects the increase of market concentration implied by the hypothetical combination of BlackRock's and Barclays Global Investors' equity portfolios in 2009Q1. The shaded areas are those markets used as treatment and controls in the discrete implementation of the instrument. We use the whole distribution in a continuous-treatment specification.

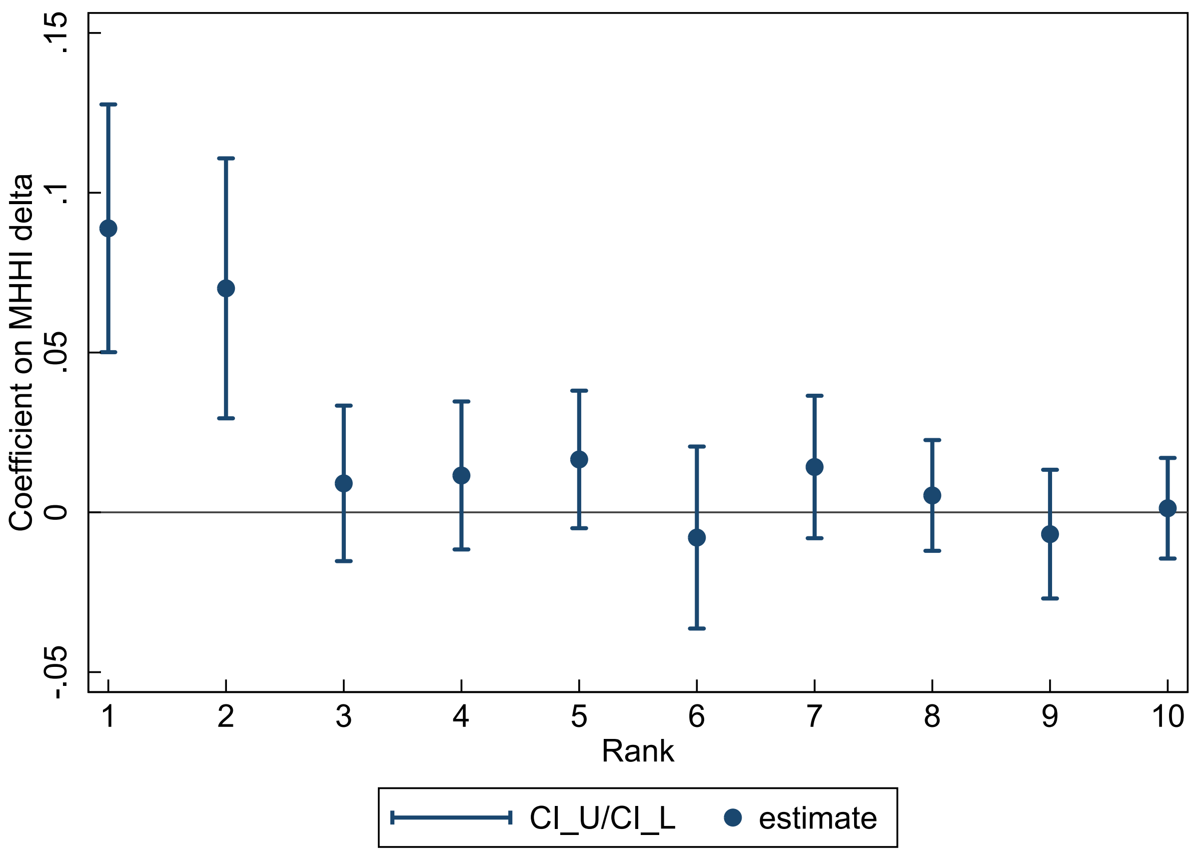

Figure C.4: Effect of common ownership on ticket prices by shareholder rank.

This graph plots the effect of MHHI deltas calculated as if only the shareholder of a given rank controlled the firm. We show the effect for shareholder ranks from 1 to 10. It is derived from a market-level regression of prices based on Table 2 specification (6), but with the alternative calculation of the MHHI delta instead of the one in the baseline. We weight by average passengers for the market carrier over time and cluster standard errors two-ways at the market-carrier and year-quarter level.

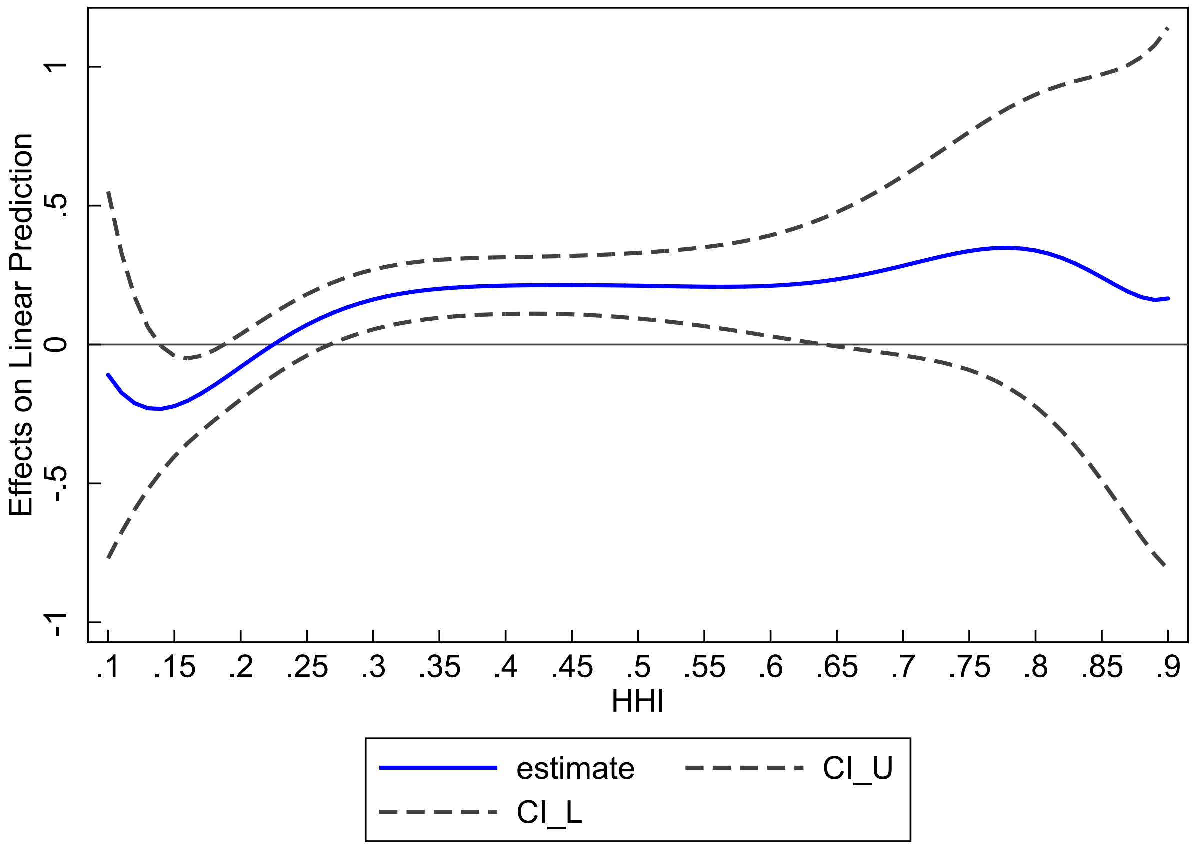

Figure C.5: Effect of common ownership on ticket prices, by levels of market concentration measured by HHI.

This graph plots the effect of MHHI delta by HHI, whereas HHI is measure on a scale from 0 to 1. It is derived from a market-level regression of prices based on Table 2 specification (6), but with MHHI delta interacted with a 10th-order polynomial in HHI. We weight by average passengers for the market over time and cluster standard errors two-ways at the market and year-quarter level.

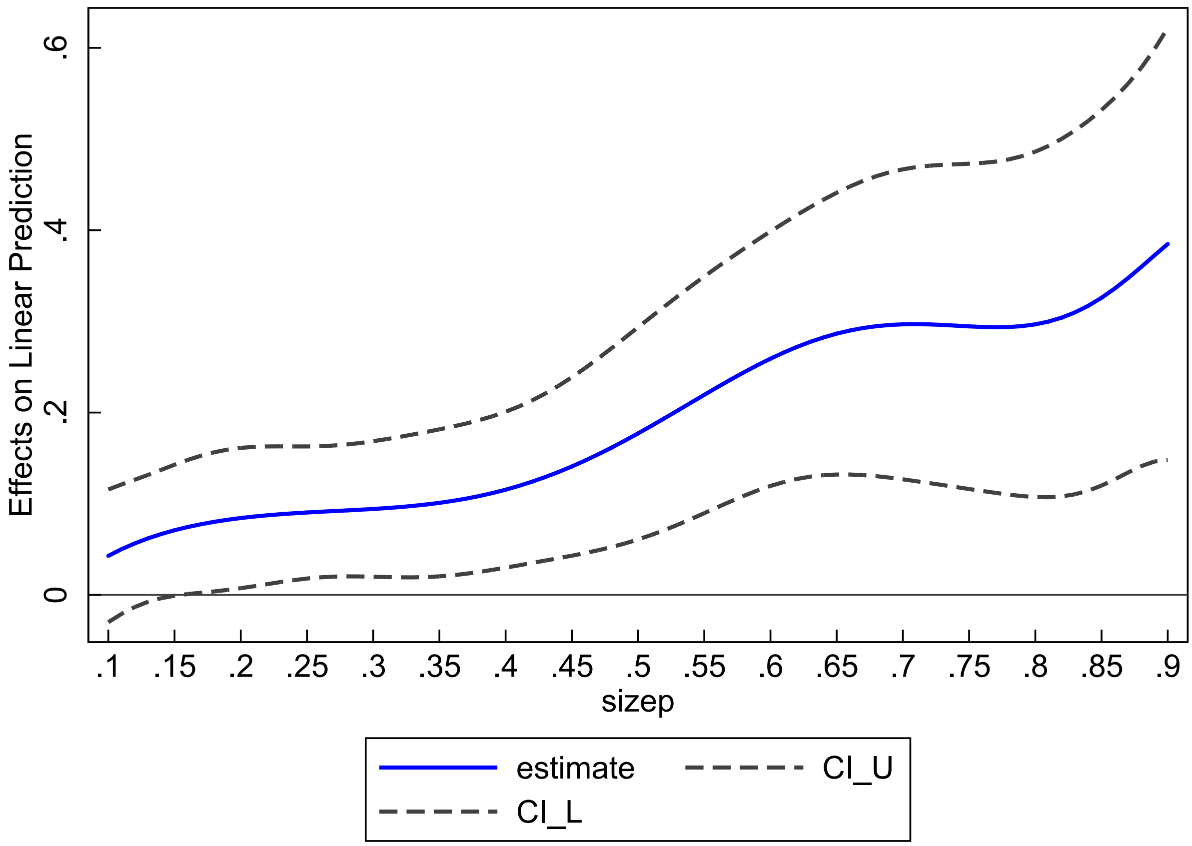

Figure C.6: Effect of common ownership on ticket prices, by market size percentile.

This graph plots the effect of MHHI delta by market size percentiles, expressed as a fraction from 0 to 1. It is derived from a market-level regression of prices based on Table 2 specification (6), but with MHHI delta interacted with a 10th-order polynomial in market size percentiles. We weight by average passengers for the market over time and cluster standard errors two-ways at the market and year-quarter level.