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# Common Ownership Does Not Have Anticompetitive Effects in the Airline Industry

PATRICK DENNIS, KRISTOPHER GERARDI, and CAROLA SCHENONE

## ABSTRACT

Institutions often own equity in multiple firms that compete in the same product market. Prior research has shown that these institutional "common owners" induce anticompetitive pricing behavior in the airline industry. This paper reevaluates this evidence and shows that the documented positive correlation between common ownership and airline ticket prices stems from the market share component of the common ownership measure, and not the ownership and control components. We further show that the results are sensitive to measures of investor control and to assumptions about equity holders' ownership and control during bankruptcy.

THE ROLE OF INSTITUTIONAL INVESTORS in financial markets has increased dramatically over the past few decades, with the institutional share of publicly traded equity rising from 33% in 1980 to 61% in 2018.[1] This trend

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Correspondence: Carola Schenone, McIntire School, University of Virginia, Finance Area Rouss and Roberston Halls, Charlottesville, VA 22903; email: schenone@virginia.edu

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[1] Institutional ownership data come from Refinitiv; U.S. stock market capitalization data come from CRSP. Percentages are measured at the end of the first quarter of each year.

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has attracted significant interest from researchers, who have focused on the economic benefits and costs of large institutions managing funds on behalf of investors. Institutional managers provide many benefits to individual investors, including increased exposure to asset classes not otherwise available to small investors and economies of scale that allow managers to provide low-cost portfolio diversification.

The costs of institutional ownership, however, are less clear. Institutions often own significant equity in multiple firms, including those that compete in the same product market. Many product market rivals are therefore partially owned by the same "common" institutional investor, which raises concerns about the potential for common owners to induce or even mandate anticompetitive pricing behavior among product market rivals in their portfolios. For instance, Azar, Schmalz, and Tecu (2018, hereafter AST) find evidence in the airline industry of a causal relationship between the concentration of common ownership in a market and average ticket prices in the market. This finding has led legal scholars and policymakers to pressure antitrust authorities to investigate the extent to which institutional ownership is associated with anticompetitive behavior.[2]

In this paper, we present empirical evidence, suggesting that the positive correlation between the measure of common ownership concentration and airline ticket fares documented in AST does not reflect a causal relationship. We begin our analysis by reproducing the data sample and replicating the main results in AST using their measure of common ownership, $HHI\Delta$. This measure aims to capture the change in market concentration induced by investors who own shares in rival firms that compete against each other.[3] The main finding in AST is a positive and statistically significant coefficient estimate in a regression of average airline ticket prices on $HHI\Delta$. This result has been widely interpreted as evidence that higher common ownership concentration leads to anticompetitive behavior.

Our first and primary finding is that the positive and significant $HHI\Delta$ coefficient estimate is driven by variation in airline market shares rather than variation in institutional ownership. The $HHI\Delta$ measure of common ownership is a nonlinear function of each firm's market share, as well as institutional investors' control and cash-flow rights in each of the firms that serve in a given market. Thus, before one can conclude that common ownership leads to higher ticket prices, one needs to determine whether identification arises from the market share component or the ownership/control component of the measure. We do so using placebo analysis. Specifically, we construct two alternative

[2] Posner et al. (2016) proposed that Congress pass legislation to withdraw tax advantages for retirement funds that invest in any mutual fund owning shares in multiple firms in the same industry, and that investors "limit their holdings of an industry to a small stake (less than 1% of the total size of the industry), or hold shares in only a single 'effective firm' per industry." Elhauge (2015) argues for enforcement of the Clayton Act, specifically §7, to challenge stock acquisitions that result in a common set of investors owning shares in corporations that are horizontal competitors.

[3] We define $HHI\Delta$ in detail in the Section I.

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measures of *HHI*Δ. The first mutes time-series variation in *HHI*Δ that originates from time-series variation in ownership and control while retaining time-series and cross-sectional variation stemming from market shares. The second placebo measure instead this mutes the time-series variation in *HHI*Δ originating from time-series variation in market shares while retaining the variation in *HHI*Δ that arises from ownership and control. We find that the first measure is positively correlated with prices, whereas the second is statistically uncorrelated with average ticket prices. These results indicate that it is variation in market shares, not in ownership or control, that drives the correlation between *HHI*Δ and prices. This finding casts doubt on the interpretation of the AST results, namely, that common ownership leads to anticompetitive effects.

In the remainder of the paper, we show that reasonable alternative empirical assumptions for measuring investor control and for treating the extent of investor ownership and control of airlines operating in bankruptcy lead to highly attenuated correlations between prices and common ownership.

We argue that while measuring an institutional investor's ownership in a firm is relatively straightforward, as it equals the percentage of shares the institution owns out of the firm's total outstanding shares, measuring the extent of investor control is not as simple. The literature on corporate governance has identified two channels through which equity holders exert control. The first is direct intervention or "voice" (Hirschman (1970)). Examples of the voice mechanism include communication between shareholders and firm managers, discussions between shareholders and board members outside management, and shareholders' vote to implement profitable projects or terminate underperforming managers. The second channel, recently revisited theoretically by Edmans (2009), Admati and Pfleiderer (2009), and Edmans and Manso (2011), involves the threat of exit, whereby shareholders discipline managers with by "voting with their feet" and selling their shares if dissatisfied with management performance. AST assume that shareholders exert control exclusively through voting and equate control with the number of shares designated as having voting rights. We take a more agnostic approach and consider both mechanisms through which equity holders discipline managers. After replicating the AST measure of control by vote, we explore how the results are affected if shareholders instead exert control through the threat of exit or through any of the alternative voice mechanisms available to *all* equity owners, regardless of the voting designations associated with the shares owned. We find that the positive correlation between *HHI*Δ and ticket prices in AST becomes statistically insignificant when control is assumed to operate through these alternative mechanisms. Further, we show that voting designations are classified inconsistently both across institutions and within institutions over time, likely due to the vague definitions and unclear reporting instructions provided by the Securities and Exchange Commission (SEC). These results cast doubt on the accuracy of capturing the extent of an institution's control using reported voting designations.

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Next, we show that the positive relationship between airline prices and common ownership is particularly sensitive to assumptions about investor control and ownership in a bankrupt carrier. Bankruptcy is a significant issue in this context as at least one major airline operated under bankruptcy protection in half of the quarters in the sample period (2001:Q1 to 2014:Q4). AST assume that equity holders retain full control and cash-flow rights over insolvent airlines. We show that alternatively assuming that equity holders of bankrupt airlines either lose cash-flow rights or retain cash flow rights but lose control materially affects the AST results.

Finally, we show that the correlation between common ownership and airline prices is also sensitive to the use of airline passenger counts as regression weights in the AST regression specification. Reestimating these regressions without weights yields significantly lower conditional correlations between common ownership and average ticket prices.

Taken together, our results suggest that common ownership does not exert a causal effect on airline ticket prices. Rather, the results are consistent with variation in market shares—not common ownership—driving the positive correlation documented in AST and imply that the AST results should not be used as a basis for regulation that would limit asset management consolidation.

While we conclude that the evidence on common ownership and prices is inconclusive in the airline industry, the literature on the potential anticompetitive effects of common ownership is expanding to consider other industries and other measures of nonprice competition, such as entry, investment, product quality, and quantity (see, for example, He and Huang (2017), Kennedy et al. (2017), Backus et al. (2019), Egland et al. (2020), Gilje et al. (2020), Eldar and Grennan (2021), Koch et al. (2021), Lewellen and Lowry (2021), and Li et al. (2021)). These studies do not find compelling evidence that common ownership leads to anticompetitive effects, but further research that looks at a more expansive set of industries is needed before any broad conclusions are drawn.

The rest of the paper is organized as follows. Section I introduces the measure of common ownership used in the AST analysis, reconstructs the data set, and replicates the paper's main regression results. Section II shows that it is variation in market shares and not variation in ownership and control that drives the AST results. Section III shows that the AST results are sensitive to the mapping between investor control and reported voting designations. In Section IV, we show that the results are also sensitive to the treatment of equity holders' ownership and control of bankrupt airlines, and to the econometric specification of the AST pricing model. Section V briefly addresses two issues concerning data construction that play a more prominent role in earlier versions of this paper. Finally, Section VI concludes.

## I. Revisiting the AST Analysis

In this section, we present the baseline framework and assumptions in AST, focusing on data construction, the measure of common ownership, and the econometric analysis.

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### *A. Measure of Common Ownership and Econometric Specification*

O'Brien and Salop (2000) derive a theoretical measure of cross ownership that results from a manager maximizing the profits accruing to owners of her firm plus the profits these owners obtain from investments in other firms, including product market rivals. This measure, $HHI\Delta$, is closely related to the traditional measure of industry concentration, namely, the Herfindhal Index, $HHI$, which equals the sum of the squared market shares of each firm $j$ in the market: $HHI = \sum_j s_j^2$. Just as $HHI$ measures the extent of product market concentration in a market, $HHI\Delta$ measures the additional market concentration in a market due to cross ownership. AST extrapolate from the theoretical construct of O'Brien and Salop (2000) for *cross* ownership and apply $HHI\Delta$ to an empirical setting for *common* ownership.[4]

Formally, $HHI\Delta$ for market $r$ at time $t$ is given by

$$HHI\Delta_{rt} = \sum_j \sum_{k \neq j} \underbrace{\left( \frac{\sum_i \gamma_{ijt} \cdot \beta_{ikt}}{\sum_i \gamma_{ijt} \cdot \beta_{ijt}} \right)}_{\text{Ownership \& Control}} \underbrace{s_{rjt} \cdot s_{rkt}}_{\text{Market Shares}}, \tag{1}$$

where $\gamma_{ij}$ represents owner $i$'s control over carrier $j$ (measured as the number of shares that owner $i$ votes in carrier $j$'s annual shareholders' meeting), and $\beta_{ij}$ represents owner $i$'s cash-flow rights in carrier $j$ (measured as the number of shares that $i$ owns in carrier $j$). Both $\gamma_{ij}$ and $\beta_{ij}$ are expressed as a fraction of total shares outstanding.[5,6] The numerator of the expression captures the idea that if owner $i$ has some control in firm $j$ and cash-flow rights to firm $k$, $\gamma_{ij} > 0$ and $\beta_{ik} > 0$ with $k \neq j$, then owner $i$ will use her control in firm $j$ to make $j$ compete less aggressively against firm $k$, thereby increasing $HHI\Delta$, and ultimately allowing $j$ and $k$ to increase prices in the market that both firms serve. The denominator of the expression captures the extent to which this effect is attenuated when owner $i$ has both ownership and control in firm $j$, $\gamma_{ij} > 0$ and $\beta_{ij} > 0$, as $HHI\Delta$ decreases in $\gamma_{ij}\beta_{ij}$. The increase in $HHI\Delta$ due to the common ownership components (control and cash-flow rights) is proportional to the market shares, $s_j$, of the airlines.[7]

The main econometric specification in the AST analysis is a regression of the logarithm of the average airfare charged by carrier $j$ in market (i.e., route) $r$ during year-quarter $t$ on the measure of common ownership, $HHI\Delta_{rt}$, the

[4] Common ownership—an investor owning shares in two or more competitors—is not the same as cross ownership, which refers to a firm holding a large financial equity stake in a rival firm operating in the same product market. See Kennedy et al. (2017) and Rock and Rubinfeld (2017), among others, for a discussion of the theoretical extrapolation that the AST analysis makes from cross to common ownership.

[5] If $\sum_i \gamma_{ijt}\beta_{ijt} = 0$, we drop the term from the summation.

[6] We return to the distinction between voting and cash-flow rights in Section III.

[7] See Bresnahan and Salop (1986) and O'Brien and Salop (2000) for details on the exact derivation of $HHI\Delta$. We include some of the details on the construction of $HHI\Delta$ as well as a simple example in Section I of the Internet Appendix. The Internet Appendix is available in the online version of this article on The website.

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traditional Herfindahl Index, $HHI_{rt}$, a set of control variables, year-quarter fixed effects, and market-carrier fixed effects,

$$\log(p_{rjt}) = \alpha \cdot HHI\Delta_{rt} + \eta \cdot HHI_{rt} + \theta \cdot X_{rjt} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}, \tag{2}$$

where $p_{rjt}$ is the average ticket price for airline $j$ in market $r$ and year-quarter $t$, $HHI_{rt}$ is industry concentration in market $r$ at time $t$, and $HHI\Delta_{rt}$ is the additional effect arising from common ownership. Standard errors are double-clustered by market-carrier and by year-quarter.[8] All regressions are weighted by the average number of passengers for the market and carrier over time, an issue we explore in Section IV.B.

In addition to pricing regressions at the market-carrier level, AST also estimate market-level regressions of the form

$$\log(p_{rt}) = \beta \cdot HHI\Delta_{rt} + \gamma \cdot HHI_{rt} + \theta \cdot X_{rt} + \alpha_t + \nu_r + \varepsilon_{rt}, \tag{3}$$

where $p_{rt}$ is the average price of a ticket in market $r$ at time $t$ across all carriers serving market $r$ at time $t$. In these regressions, standard errors are double-clustered by market and year-quarter, while regression weights are given by the average number of passengers in the market over time.

The AST analysis reports three separate regression specifications. The first includes year-quarter and market-carrier fixed effects with no other covariates. The second adds the logarithm of the distance between endpoint airports interacted with year-quarter fixed effects. The third adds additional market characteristics as covariates.[9]

### *B. Replication of the AST Data Set and Regression Analysis*

A kit to replicate the AST analysis, available from *The Journal of Finance*'s website, includes the Stata code for filtering the raw data, conducting the empirical analysis, and replicating the tables and figures in AST. It does not include the two primary data sources.[10] We obtain these data and apply them to the replication kit to reconstruct the AST estimation sample and main results.

[8] The explanatory variable of interest, $HHI\Delta_{rt}$, varies at the market level. Thus, based on Moulton (1986), clustering should be done at the market level rather than the market-carrier level. However, to facilitate comparison, we use the same clustering methods employed in the AST analysis throughout this paper.

[9] The AST analysis includes the distance between endpoint airports 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" (AST, page 14). Covariates in the third specification include: number of carriers operating nonstop flights in each market, indicator variables for whether Southwest or another low-cost carrier (LCC) operates a nonstop flight in the market, the share of passengers traveling with connections (at both the market-carrier and the market level), the log of the geometric mean of the population, and per-capita income in the two market-endpoint cities.

[10] Institutional ownership data come from Refinitiv and are proprietary, while airline data are publicly available. Details on data sources and sample construction are in Section II of the Internet Appendix.

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For ease of comparison, we reproduce the AST regression estimates (located in Table III in AST) in columns (1) to (3) in Table I.[11] Panel A displays results for market-carrier regressions, while Panel B shows the market-level estimates. Results using our reconstruction of the AST data sample and regression specifications are reported in columns (4) to (6) of each panel. We replicate the AST results to the third decimal place in the base specification and to the second decimal place in the more saturated specifications. The coefficient estimate on $HHI\Delta$ is statistically significant and economically large in magnitude: a one-standard-deviation increase in $HHI\Delta$ is correlated with mean prices that are 1.7% to 2.2% higher at the market carrier level and 2.2% to 3.6% higher at the market level. Furthermore, an increase in $HHI\Delta$ from zero (no common ownership) to a level corresponding to the maximum amount of common ownership observed in the sample is correlated with an increase in prices of 8.5% to 11.3% at the market-carrier level and 11.4% to 19.8% at the market level. In the remainder of the paper, we explore the nature of this positive relationship between average ticket prices and $HHI\Delta$.

## II. Sources of Identification

There is an important conceptual concern with the pricing regressions estimated in AST. To see this, we rewrite equation (2) substituting the formula for $HHI\Delta$ from equation (1):

$$\log(p_{rjt}) = \alpha \cdot \overbrace{\sum_j \sum_{k \neq j} \underbrace{\left( \frac{\sum_i \gamma_{ijt} \cdot \beta_{ikt}}{\sum_i \gamma_{ijt} \cdot \beta_{ijt}} \right)}_{\text{Ownership \& Control}} \underbrace{s_{rjt} \cdot s_{rkt}}_{\text{Market Shares}}}^{HHI\Delta} + \eta \cdot \overbrace{\sum_j \underbrace{s_{rjt}^2}_{\text{Market Shares}}}^{HHI} + \theta \cdot X_{rjt} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}. \quad (4)$$

Equation (4) shows that the AST specification is a regression of average prices on two functions of market shares, namely, the traditional $HHI$ and $HHI\Delta$. Focusing on $HHI\Delta$, we note that it is a nonlinear function of both market shares and the ownership/control parameters. The interpretation of the AST results is that increased common ownership by institutional investors, that is, higher $HHI\Delta$, decreases competition and thus increases airline ticket prices. However, to support this interpretation, it is necessary to determine whether the source of identification of the $HHI\Delta$ coefficient is its market share component or its ownership/control components. If the positive correlation between $HHI\Delta$ and prices is driven mainly by variation in airline market shares,

[11] Table IA.I in Section III of the Internet Appendix shows that we closely match the AST sample. Our observation counts are always within 500 observations of the AST counts (a deviation of 0.02% from the AST sample), and the means and standard deviations of all variables are extremely close for both the market-carrier and the market-level samples.

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**Table I**
## Replicating AST Results

Panel A reproduces the reported estimates for market-carrier-level regressions reported in AST's Table III, columns (1) to (3). Our replication of those results are in columns (4) to (6). The regression equation is

$$\log(p_{rjt}) = \beta \cdot HHI\Delta_{rt} + \gamma \cdot HHI_{rt} + \theta \cdot X_{rjt} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}.$$

Panel B reproduces the reported estimates for market-level regressions reported in AST's Table III, in columns (1) to (3). Our replication of those results is shown in columns (4) to (6). The regression equation is

$$\log(p_{rt}) = \beta \cdot HHI\Delta_{rt} + \gamma \cdot HHI_{rt} + \theta \cdot X_{rt} + \alpha_t + \nu_r + \varepsilon_{rt}.$$

In both models, $\log(p_{rjt})$ is the logarithm of the average ticket fare of airline $j$ in market $r$ and year-quarter $t$, $HHI_{rt}$ is the traditional Herfindahl Index, $HHI\Delta_{rt}$ is the additional concentration due to common owners, and $X_{rjt}$ is a set of control variables. All regressions are weighted by the average passengers for the market-carrier over time. The sample covers the period 2001:Q1 to 2014:Q4. Both equations include year-quarter fixed effects. Panel A includes market-carrier fixed effects. Panel B includes market fixed effects. Standard errors, clustered by year-quarter and market-carrier (Panel A) and market (Panel B), are reported in parentheses. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Panel A: Market-Carrier-Level Regressions

| | AST | | | DGS | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *HHI*Δ | 0.194*** | 0.219*** | 0.149*** | 0.194*** | 0.218*** | 0.147*** |
| | (0.046) | (0.039) | (0.038) | (0.046) | (0.039) | (0.038) |
| *HHI* | 0.221*** | 0.230*** | 0.165*** | 0.222*** | 0.230*** | 0.163*** |
| | (0.025) | (0.025) | (0.021) | (0.025) | (0.025) | (0.021) |
| Number of Nonstop Carriers | | | −0.010*** | | | −0.011*** |
| | | | (0.003) | | | (0.003) |
| Southwest Indicator | | | −0.120*** | | | −0.119*** |
| | | | (0.009) | | | (0.009) |
| Other LCC Indicator | | | −0.062*** | | | −0.060*** |
| | | | (0.007) | | | (0.007) |
| Share of Passengers Traveling Connect, Market-Level | | | 0.124*** | | | 0.123*** |
| | | | (0.017) | | | (0.017) |
| Share of Passengers Traveling Connect | | | 0.099*** | | | 0.105*** |
| | | | (0.014) | | | (0.014) |
| Log(Population) | | | 0.306*** | | | 0.306*** |
| | | | (0.106) | | | (0.106) |
| Log(Income Per Capita) | | | 0.374*** | | | 0.370*** |
| | | | (0.102) | | | (0.103) |
| Log(Distance) · Yr-Qtr FE | | x | x | | x | x |
| Yr-Qtr FE | x | x | x | x | x | x |
| Market-Carrier FE | x | x | x | x | x | x |
| $R^2$ | 0.82 | 0.83 | 0.84 | 0.82 | 0.83 | 0.84 |
| # Observations | 1,237,584 | 1,237,584 | 1,209,517 | 1,237,878 | 1,237,878 | 1,209,791 |
| # Market-Carriers | 46,513 | 46,513 | 45,248 | 46,510 | 46,510 | 45,244 |

(*Continued*)

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**Table I**—*Continued*

| Panel B: Market-Level Regressions | | | | | | |
|---|---|---|---|---|---|---|
| | AST | | | DGS | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *HHI*Δ | 0.325*** | 0.311*** | 0.202*** | 0.323*** | 0.344*** | 0.197*** |
| | (0.045) | (0.040) | (0.036) | (0.045) | (0.041) | (0.037) |
| *HHI* | 0.365*** | 0.357*** | 0.256*** | 0.365*** | 0.365*** | 0.256*** |
| | (0.032) | (0.031) | (0.024) | (0.032) | (0.033) | (0.025) |
| Number of Nonstop Carriers | | | −0.008** | | | −0.008** |
| | | | (0.004) | | | (0.004) |
| Southwest Indicator | | | −0.149*** | | | −0.150*** |
| | | | (0.014) | | | (0.014) |
| Other LCC Indicator | | | −0.100*** | | | −0.101*** |
| | | | (0.010) | | | (0.010) |
| Share of Passengers | | | 0.158*** | | | 0.179*** |
| Traveling Connect, Market-Level | | | (0.019) | | | (0.019) |
| Log(Population) | | | 0.343*** | | | 0.354*** |
| | | | (0.122) | | | (0.122) |
| Log(Income Per Capita) | | | 0.304*** | | | 0.318*** |
| | | | (0.110) | | | (0.109) |
| Log(Distance) · Yr-Qtr FE | | x | x | | x | x |
| Yr-Qtr FE | x | x | x | x | x | x |
| Market FE | x | x | x | x | x | x |
| $R^2$ | 0.85 | 0.86 | 0.88 | 0.85 | 0.86 | 0.88 |
| # Observations | 262,350 | 262,350 | 254,999 | 262,534 | 262,534 | 255,173 |
| # Markets | 7,185 | 7,185 | 6,906 | 7,190 | 7,190 | 6,911 |

then it is unlikely that common ownership is leading to anticompetitive effects in the market.[12]

### *A. What Identifies the HHI*Δ *Coefficient?*

The AST pricing regressions, equations (2) and (3), include market-carrier and market fixed effects, respectively. The *HHI*Δ coefficients in these equations are therefore identified by within-market-carrier and within-market time-series variation of average ticket prices and *HHI*Δ, respectively. This

[12] There are also multiple endogeneity concerns involved in estimating equation (4). First, since an airline's market share and the prices it charges are jointly determined in equilibrium, the unobserved factors that drive market shares could be simultaneously driving prices. AST do not address this issue, nor do we address it in this paper. We did so in earlier drafts by implementing an instrumental variables analysis that uses instruments derived from the airline literature. Second, if asset managers make investment decisions in response to changes in product market prices, then variation in average prices could be driving variation in ownership and control, resulting in bias from reverse causality. This "ownership" source of endogeneity is addressed in the AST analysis with a quasi-experimental strategy that isolates plausibly exogenous variation in common ownership created by a merger between BlackRock and Barclays Global Investors in 2009. We describe this experiment in more detail in Section X of the Internet Appendix.

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time-series variation in $HHI\Delta$ has two sources: first, the time-series variation in investor $i$'s ownership and control of the airlines serving a market and second, within a market, the time-series variation in each airline's market share. To disentangle these two sources of variation, we design a placebo test that involves constructing two new versions of $HHI\Delta$. First, we construct $HHI\Delta^{Placebo\ Own}_{True\ MS}$, a measure that eliminates time-series variation in $HHI\Delta$ that originates from variation in ownership and control while retaining time-series and cross-sectional variation stemming from market shares. Next, we reverse this strategy and construct $HHI\Delta^{Placebo\ MS}_{True\ Own}$, a measure that eliminates time-series variation in $HHI\Delta$ originating from variation in market shares while retaining time-series and cross-sectional variation in $HHI\Delta$ that arises from ownership and control. The placebo test involves reestimating equations (2) and (3) using these alternative measures of $HHI\Delta$. If the common ownership component of $HHI\Delta$ is driving the positive correlation with average prices, we would expect to find $HHI\Delta^{Placebo\ Own}_{True\ MS} \approx 0$ and $HHI\Delta^{Placebo\ MS}_{True\ Own} > 0$. In contrast, if the market shares component is driving the correlation between $HHI\Delta$ and prices, we would expect to find $HHI\Delta^{Placebo\ Own}_{True\ MS} > 0$ and $HHI\Delta^{Placebo\ MS}_{True\ Own} \approx 0$. We now turn to a more detailed discussion of how we construct our placebo $HHI\Delta$ measures and the results of these two exercises.

### *B. Placebo Ownership and True Market Shares*

The placebo ownership measure needs to eliminate time-series variation in ownership and control while retaining variation in market shares. Since $HHI\Delta$ is a nonlinear function of market shares and the ownership and control parameters, the particular level at which we fix ownership and control in the construction of $HHI\Delta^{Placebo\ Own}_{True\ MS}$ may affect the regression estimates. We address this concern by constructing multiple versions of $HHI\Delta^{Placebo\ Own}_{True\ MS}$ that fix the ownership and control components at different levels and show that the results are robust across the different measures.

Our first measure replaces the values of investor $i$'s ownership ($\beta_{ij}$) and control ($\gamma_{ij}$) in carrier $j$ for all year-quarters in our sample with those observed for $i$ and $j$ in the first year-quarter of our sample period, 2001:Q1, generating $HHI\Delta^{2001:Q1}_{True\ MS}$. This eliminates the time-series variation in the common ownership component of $HHI\Delta$ while retaining a realistic cross-sectional distribution of common ownership. We then reestimate equations (2) and (3) using $HHI\Delta^{2001:Q1}_{True\ MS}$.

We repeat this exercise for all year-quarters in our sample. Thus, in total, we construct 56 different measures, $HHI\Delta^{2001:Q1}_{True\ MS}, \ldots, HHI\Delta^{2014:Q4}_{True\ MS}$, and estimate 56 separate market-carrier- and market-level regressions.

### *C. Placebo Market Shares and True Ownership*

The placebo market share measure needs to mute time-series variation in $HHI\Delta$ that stems from variation in market shares while retaining a realistic cross-sectional distribution in market shares as well as the true time-series

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and cross-sectional variation in ownership/control. We follow a strategy similar to that for the placebo ownership exercise discussed above.

Our first placebo measure, $HHI\Delta^{2001:Q1}_{True\ Own}$, is constructed by replacing, for all year-quarters in our sample, the value of airline $j$'s market share in route $r$, $s_{jr}$, with that observed for $j$ in route $r$ in the first year-quarter of our sample period, 2001:Q1. We then reestimate equations (2) and (3) using $HHI\Delta^{2001:Q1}_{True\ Own}$. As before, we repeat the above exercise for all year-quarters in our sample. We therefore construct 56 different measures, $HHI\Delta^{2001:Q1}_{True\ Own}, \ldots, HHI\Delta^{2014:Q4}_{True\ Own}$, and estimate 56 separate market-carrier- and market-level regressions.[13]

### *D. Placebo Results*

Figure 1 displays the results of our placebo test at the market-carrier level, while Figure 2 displays the market-level results. Panel A of each figure displays coefficient estimates and 95% confidence intervals for each of the 56 versions of $HHI\Delta^{Placebo\ Own}_{True\ MS}$. Panel B of each figure displays the estimates for each of the 56 versions of $HHI\Delta^{Placebo\ MS}_{True\ Own}$.[14]

Inspection of Figure 1 suggests that the vast majority of the $HHI\Delta^{Placebo\ Own}_{True\ MS}$ coefficient estimates (Panel A) are positive, and about half are statistically significant at the 5% level. In contrast, the $HHI\Delta^{Placebo\ MS}_{True\ Own}$ coefficient estimates are statistically insignificant for almost all year-quarters, and many of the point estimates are negative.

The differences are even starker in the market-level results displayed in Figure 2. Virtually, all of the $HHI\Delta^{Placebo\ Own}_{True\ MS}$ coefficient estimates in Panel A are large, positive, and statistically significant, while almost half of the $HHI\Delta^{Placebo\ MS}_{True\ Own}$ coefficients are negative and most (over 70%) are statistically insignificant.

In Table II, we report the mean of the 56 coefficient estimates for each of our placebo measures. For the market-carrier-level regressions, the average $HHI\Delta^{Placebo\ Own}_{True\ MS}$ is 0.081 and statistically significant at the 1% level (Panel A, column (1)); in contrast, the average $HHI\Delta^{Placebo\ MS}_{True\ Own}$ is 0.027 and not significantly different from zero (Panel A, column (2)). We see a similar pattern in the market-level regressions reported in Panel B. The average of the 56 estimated $HHI\Delta^{Placebo\ Own}_{True\ MS}$ coefficients is positive large and statistically significant (0.161), while the average of the $HHI\Delta^{Placebo\ MS}_{True\ Own}$ is small and statistically insignificant (0.029). To determine statistical significance, we use standard errors that have been corrected for the serial correlation in the estimates of the 56 $HHI\Delta$ measures using two different methods. The first method simply models residuals as an AR(1) process. The second method also uses an AR(1)

[13] For all year-quarter observations in which airline $j$ serves market $m^*$, we replace $j$'s market share by the market share observed in the selected time period $t^*$: $ms_{ctm} = ms_{jt^*m^*}\ \forall\, t$. If carrier $j$ does not serve market $m^*$ during a specific year-quarter $t$, then for that period $t$, we set carrier $j$'s market share equal to zero.

[14] All regression estimates correspond to the most saturated specifications (column (3) in Table I).

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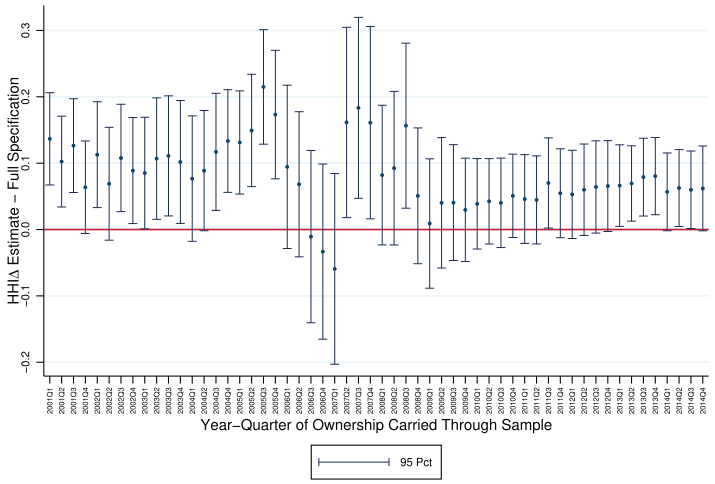
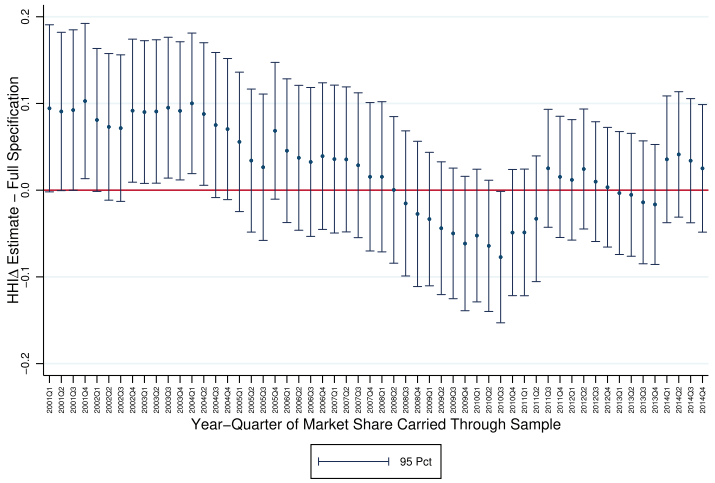
Panel (a) True Market Shares and Placebo Ownership




Market–Carrier Fixed Effects Regressions. Standard Errors Clustered at Market–Carrier and Date Level.

Panel (b) True Ownership and Placebo Market Shares




Market–Carrier Fixed Effects Regressions. Standard Errors Clustered at Market–Carrier and Date Level.

**Figure 1. Identification: Market-carrier-level regressions.** Panel A plots coefficient estimates of $HHI\Delta^{Placebo\ Own}_{TrueMS}$ for each of the 56 market-carrier-level regressions:

$$\log(p_{rjt}) = \alpha \cdot (HHI\Delta^{PlaceboOwn}_{TrueMS})_{rt} + \eta \cdot HHI_{rt} + \theta \cdot X_{rjt} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}.$$

Panel B plots coefficient estimates of $HHI\Delta^{Placebo\ MS}_{TrueOWN}$ for each of the 56 market-carrier-level regressions:

$$\log(p_{rjt}) = \alpha \cdot (HHI\Delta^{Placebo\ MS}_{True\ Own})_{rt} + \eta \cdot HHI_{rt} + \theta \cdot X_{rjt} + \alpha_t + \nu_{rj} + \varepsilon_{rjt}.$$

Point estimates are shown along with 95% confidence intervals for each of the 56 coefficient estimates. (Color figure can be viewed at wileyonlinelibrary.com)

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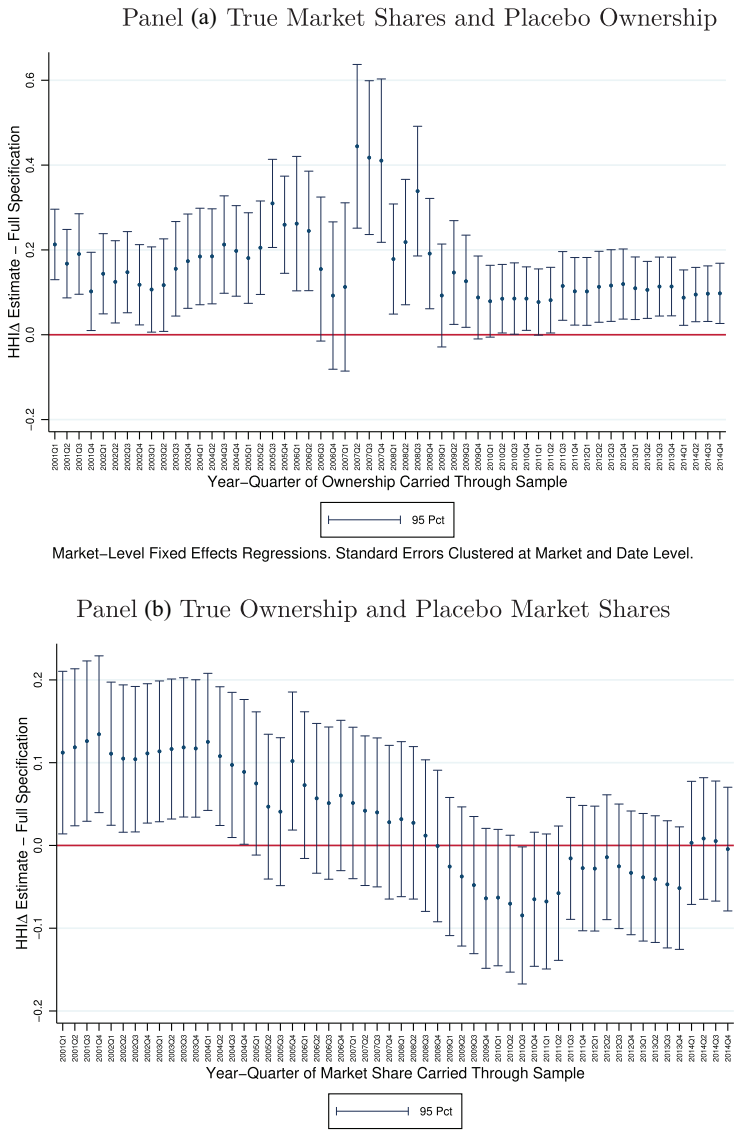


**Figure 2. Identification: Market-level regressions.** Panel A plots coefficients estimates of $HHI\Delta^{Placebo\ Own}_{TrueMS}$ for each of the 56 market-level regressions:

$$\log(p_{rt}) = \alpha \cdot (HHI\Delta^{PlaceboOwn}_{TrueMS})_{rt} + \eta \cdot HHI_{rt} + \theta \cdot X_{rt} + \alpha_t + \nu_r + \varepsilon_{rt}.$$

Panel B plots coefficients estimates of $HHI\Delta^{Placebo\ MS}_{TrueOWN}$ for each of the 56 market-level regressions:

$$\log(p_{rt}) = \alpha \cdot (HHI\Delta^{Placebo\ MS}_{True\ Own})_{rt} + \eta \cdot HHI_{rt} + \theta \cdot X_{rt} + \alpha_t + \nu_r + \varepsilon_{rt}.$$

Point estimates are shown along with 95% confidence intervals for each of the 56 coefficient estimates. (Color figure can be viewed at wileyonlinelibrary.com)

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**Table II**
**Identification: Placebo Results**

This table reports the mean and standard error of the 56 coefficient estimates for *HHI*Δ for our placebo regressions corresponding to true market shares and placebo ownership (column (1)) and true market shares and placebo market share and true ownership (column (2)). Standard errors are computed two ways. Method 1 computes the standard error for the mean using only the 56 point estimates. Method 2 computes the standard error for the mean using both the 56 point estimates and their individual standard errors from the panel regressions. Both methods model the residuals as an AR(1) process. Further details are provided in Section IV of the Internet Appendix. Panel A reports market-carrier-level regressions, and Panel B reports market-level regressions. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Panel A: Market-Carrier-Level Regressions

| | True Market Shares Placebo Ownership/Control (1) | Placebo Market Shares True Ownership/Control (2) |
|---|---|---|
| Mean of 56 *HHI*Δ estimates | 0.081*** | 0.027 |
| Standard Error Computation: | | |
| Method 1 | (0.014) | (0.032) |
| Method 2 | (0.011) | (0.024) |

Panel B: Market-Level Regressions

| | True Market Shares Placebo Ownership/Control (1) | Placebo Market Shares True Ownership/Control (2) |
|---|---|---|
| Mean of 56 *HHI*Δ estimates | 0.161*** | 0.029 |
| Standard Error Computation: | | |
| Method 1 | (0.027) | (0.053) |
| Method 2 | (0.016) | (0.030) |

process for the residuals but incorporates the additional information that we have on the standard errors of each of the 56 coefficient estimates.[15]

These results suggest that identification of the *HHI*Δ coefficient is not driven by time-series variation in the common ownership component of *HHI*Δ. Replacing ownership and control with time-invariant placebo values in *HHI*Δ while retaining true market shares yields positive and statistically significant coefficient estimates. In contrast, replacing market shares in *HHI*Δ with placebo values while retaining true ownership and control yields economically and statistically insignificant coefficient estimates.

### *E. Model-Free HHI*Δ

Finally, as an alternative to the placebo market share exercise, we build a "model-free" measure of common ownership. This strategy replaces a carrier's

[15] The serial correlation in the 56 *HHI*Δ estimates is created by persistence in airline market shares and in institutional ownership over time. We detail both methods for calculating the standard errors in Section IV of the Internet Appendix.

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**Table III**
**"Model-Free" *HHI*Δ**

This table reports the second market share placebo test aimed at disentangling the effect of ownership, $\sum_j \sum_{k \neq j} (\frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}})$, from that of market share, $s_j s_k$, in *HHI*Δ. The market share placebo, $HHI\Delta^{MS=1}_{True\ Own}$, replaces a carrier's market share with the value of one if the carrier serves the market in a particular quarter, and zero otherwise. Estimates reported in column (1) correspond to market-carrier-level regressions, estimates in column (2) to market-level regressions. We use the saturated specifications. Robust standard errors, in parentheses, are clustered by year-quarter and market-carrier (market) in Panel A (B). Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

| | Market-Carrier FE (1) | Market FE (2) |
|---|---|---|
| $HHI\Delta^{Placebo\ MS=1}_{True\ Own}$ | −0.001 | −0.002** |
| | (0.001) | (0.001) |
| *HHI* | 0.121*** | 0.190*** |
| | (0.018) | (0.022) |
| Log(Distance) · Year-Quarter FE | x | x |
| Full Set of Controls | x | x |
| Year-Quarter FE | x | x |
| Market-Carrier FE | x | x |
| Market FE | x | x |
| $R^2$ | 0.8360 | 0.8753 |
| # Observations | 1,209,791 | 255,173 |
| # Market-carriers | 45,244 | |
| # Markets | | 6,911 |

market share with the value of one if the carrier serves the market in a particular quarter and zero otherwise. Recall that *HHI*Δ is a weighted average of an institution's ownership and control in firms within an industry, where the weights are given by a firm's market share. By setting market shares equal to one, we mute the market share weights and retain the ownership terms.[16] Results for market-carrier- and market-level regressions using this alternative placebo are displayed in columns (1) and (2) of Table III, respectively. In both regressions, the *HHI*Δ coefficient estimates are not statistically different from zero.

Taken together, the results in Tables II and III and in Figures 1 and 2 suggest that the positive relationship between average ticket prices and *HHI*Δ documented in AST is driven primarily by within-market-carrier time-series variation in airline market shares rather than variation in the extent of investor ownership and control.[17]

[16] We thank Daniel Ferreira for this suggestion.

[17] These results are also consistent with Gilje, Gormley, and Levit (2020), who develop several measures of common ownership (termed *GGL*) that are free of the market share component of *HHI*Δ and use them to reestimate the AST pricing regressions (Appendix D in their paper).

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## III. Mapping Investor Control

The theoretical construct of common ownership derived by O'Brien and Salop (2000), $HHI\Delta$, contains measures of shareholders' ownership and control over the firm. Specifically, in equation (1), $\gamma_{ij}$ represents owner $i's$ control of carrier $j$ and $\beta_{ij}$ represents owner $i's$ cash-flow rights in carrier $j$.

When AST adopt this measure and take it to the data, the authors map cash-flow rights to ownership, setting $\beta_{ij}$ to the ratio of the number of shares an institution owns to the total number of outstanding shares of the firm. They then map control to voting rights and set $\gamma_{ij}$ to the proportion of shares for which the investor reports sole or shared voting power. While the proxy for cash flow is straightforward, the proxy for control is less so.

Below, we examine how shareholders exert control over firm management and discuss different ways to capture control in constructing $HHI\Delta$. We show that measuring control with voting designations as AST do yields the results on anticompetitive effects of common ownership while using a measure that captures a shareholder's threat of selling shares does not.

### A. *How Investors Exert Control?*

The literature on corporate governance identifies two channels through which shareholders typically exert control, namely, "voice" and "exit."[18] Control through voice involves direct shareholder intervention. This includes taking an array of actions to discipline management when shareholders are not content with managerial performance, such as communication with and firm managers and voting in shareholder meetings.

Shareholders may also exert control through the threat of exit, whereby shareholders discipline firm managers via their ability to "vote with their feet" and sell their stock if dissatisfied with management performance. The threat of shareholder exit as a means of imposing control has gained renewed attention in prominent theoretical work of Edmans (2009), Admati and Pfleiderer (2009), and Edmans and Manso (2011), and in the empirical evidence of McCahery, Sautner, and Starks (2008).

Notably, Edmans (2009) theoretically shows that, even if equity holders are unable to intervene by engaging in voice, they can still exercise control by selling their shares. Consistent with this view, the survey analysis of McCahery, Sautner, and Starks (2008) finds that both voice and exit are quantitatively important channels through which institutional investors exert control. Specifically, the paper finds that 53% of surveyed investors reported engaging in control by voting against management, while 56% reported exerting control by selling shares when dissatisfied with firm performance or corporate governance.

[18] For one of the first expositions of voice and exit, see Hirschman (1970) and his work on "Exit, Voice, and Loyalty."

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### *B. Voting as a Proxy for Control through Voice*

The SEC requires that institutional investors classify the shares they own into one of three mutually exclusive categories based on the shares' voting rights: sole, shared, or no voting power. We discuss these designations in detail in Section III.D.[19] AST use these designations to proxy for an institution's control over a firm. Specifically, for each year-quarter, AST set institution $i$'s control of carrier $j$ ($\gamma_{i,j}$ in $HHI\Delta$) to the number of shares that institution $i$ declares it has sole or shared voting rights over divided by the total number of carrier $j$'s shares outstanding. For shares designated with no voting rights, $\gamma_{i,j}$ is set to zero in the $HHI\Delta$ formula, and the investor is assumed to exert no control over the firm's management. Here, we refer to this measure as $HHI\Delta_{Sole+Shared}$ to highlight which voting rights are used to proxy for control. In the first column of Table IV, for ease of comparison, we replicate AST's estimation results using this measure for the most saturated specification (column (6) in Table I).

### *C. Exit as a Proxy for Control*

To capture the fact that institutions can exert control by threat of exit or by voice mechanisms not confined to the voting power of the shares an institution owns, we construct $HHI\Delta_{Exit}$, where the control parameter, $\gamma_{i,j}$, is equal to the fraction of shares that investor $i$ owns in airline $j$, $\beta_{ij}$. Importantly, $HHI\Delta_{Exit}$ does not rely on voting designations to define shareholder control. Rather, this measure, even investors who report no voting rights retain control, consistent with the conclusion in Edmans (2009) that "even if equity holders are unable to intervene by engaging in voice, they can still exercise control as they can choose to exit." Thus, the difference between the two measures comes entirely from the treatment of shares designated as having no voting rights as $HHI\Delta_{Exit} = HHI\Delta_{Sole+Shared+No}$.

Estimates for the coefficient on $HHI\Delta_{Exit}$ are reported in column (2) of Table IV. The coefficient estimate drops from an economically and statistically significant value of 0.147 to an insignificant value of 0.044 in the market-carrier-level regressions and by almost 50% in magnitude (from 0.197 to 0.106) while retaining statistical significance in the market-level regressions.

### *D. Discussion*

The estimates reported in Table IV show that the AST result on the relationship between common ownership and ticket prices is sensitive to the proxy used to capture how shareholders exert control over the management of their portfolio firms. When control is captured using voting designations exclusively, we obtain the anticompetitive result. However, if an investor's influence is measured using their ability to sell the shares they own, then anticompetitive effects do not obtain (in the market-carrier regressions).

[19] See https://www.sec.gov/about/forms/form13f.pdf , and "Special Instruction 12.b.viii" to SEC Form 13F.

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**Table IV**

## Identification: The Effect of Voting Designations

This table presents results for two different measures of $HHI\Delta$, based on different proxies for shareholder control. Shares owned by any institution can be designated as having "sole," "shared," or "no" voting authority. AST's measure, $HHI\Delta = HHI\Delta_{Sole+Shared}$, identifies control using shares designated with sole and shared voting rights. Alternatively, control can be captured by shareholders' ability to exit, and thus identified by the shares an institution owns, regardless of each share's voting designation, $HHI\Delta_{Exit} = HHI\Delta_{Sole+Shared+No}$. Panel A reports market-carrier-level regressions (equation (2)), and Panel B reports market-level regressions (equation (3)). We present results for the most saturated specification. In each panel, column (1) presents our replication of the AST results using $HHI\Delta = HHI\Delta_{Sole+Shared}$ for ease of comparison, while column (2) presents results using $HHI\Delta_{Exit}$. Robust standard errors, in parentheses, are clustered by year-quarter and market-carrier (Panel A) and market (Panel B). Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Panel A: Market-Carrier-Level Regressions

| Voting Designation: | $HHI\Delta_{Sole+Shared}$ (1) | $HHI\Delta_{Exit} = HHI\Delta_{Sole+Shared+No}$ (2) |
|---|---|---|
| $HHI\Delta$ | 0.147*** | 0.044 |
| | (0.038) | (0.031) |
| $HHI$ | 0.163*** | 0.138*** |
| | (0.021) | (0.021) |
| Log(Distance) · Year-Quarter FE | x | x |
| Full Set of Controls | x | x |
| Year-Quarter FE | x | x |
| Market-Carrier FE | x | x |
| $R^2$ | 0.84 | 0.84 |
| # Observations | 1,209,791 | 1,209,791 |
| # Market-carriers | 45,244 | 45,244 |

Panel B: Market-Level Regressions

| Voting Designation: | $HHI\Delta_{Sole+Shared}$ (1) | $HHI\Delta_{Exit} = HHI\Delta_{Sole+Shared+No}$ (2) |
|---|---|---|
| $HHI\Delta$ | 0.197*** | 0.106*** |
| | (0.037) | (0.034) |
| $HHI$ | 0.256*** | 0.236*** |
| | (0.025) | (0.025) |
| Log(Distance) · Year-Quarter FE | x | x |
| Full Set of Controls | x | x |
| Year-Quarter FE | x | x |
| Market FE | x | x |
| $R^2$ | 0.88 | 0.88 |
| # Observations | 255,173 | 255,173 |
| # Markets | 6,911 | 6,911 |

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The significantly different results are surprising as voice and exit are considered complementary mechanisms in the literature. In fact, Levit (2019) shows that the exit option can improve the effectiveness of voice, and Dasgupta and Piacentino (2015) show that management only listens to shareholders if voice is backed up by the threat of exit. Consistent with these theoretical findings, survey evidence in McCahery, Sautner, and Starks (2008) shows that investors use both voice and exit to exert control over firms in their portfolio, and that investors believe exit to be a viable strategy and a complement to voice, rather than a substitute, with intervention preceding exit.

While it is certainly possible that voting is a more potent method to exert control over firm managers, which could help explain the conflicting results in Table IV, there is reason to be skeptical that the voting designations reported to the SEC by institutional investors accurately capture true voting power. As we discuss in more detail below, these designations are vaguely defined, resulting in what appears to be arbitrary and inconsistent reporting.

According to the SEC reporting guidelines, a "sole" voting designation implies that the investor has voting authority over routine matters (selection of an accountant) and nonroutine matters (a contested election of directors, merger approval). A "no" designation covers a few specific scenarios, for instance, when shares are under subadvisory contracts or when a socially responsible investor delegates investment discretion to an institution but retains voting rights on nonroutine matters to affect voice consistent with the investor's stated social objectives.[20] Finally, a "shared" designation is somewhat ambiguous as it stems from the definition of shared investment discretion.[21,22]

The SEC provides the guidelines above but leaves interpretation and classification of voting designations to the discretion of the corporate governance

[20] Shares lent to another institution for a short sale may also be designated as having no voting rights. However, it is unlikely that this constitutes the bulk of shares with no voting rights in light of the evidence in Aggarwal et al. (2015) that investors restrict lendable supply and/or recall loaned shares prior to the proxy record date to exercise voting rights.

[21] There are two cases of shared investment discretion. The first, shared-defined investments, arise with bank holding companies and their subsidiaries, investment companies and their subadvisers, and insurance companies and their separate accounts. While investment discretion is shared in these types of relationships, SEC instructions require that the institution report voting authority as sole. See SEC form 13F special instructions section 12.b.vi.(B) and 12.b.vi.(C): "If voting authority is shared only in a manner similar to a sharing of investment discretion which would call for a response of 'shared-defined' (DEFINED) under Column 6, a Manager should report voting authority as sole under subdivision (a) of Column 8, even though the Manager may be deemed to share investment discretion with that person under Special Instruction 12.b.vi." The second case, shared-other investment discretion, pertains to any situation that is *not* shared-defined, and for these, SEC rules require that voting authority be reported as "shared." See Form 13F special instruction 12.b.viii: "Shared-Other. Designate as 'shared-other' securities (OTHER) those over which investment discretion is shared in a manner other than that described in Special Instruction (B) above."

[22] Based on the ambiguity of the "shared" voting designation, one might be concerned about AST's assumption that shareholders who report shared voting rights exert control over the airline. To address this issue, we recomputed $HHI\Delta$ so that only shareholders who report having "sole" voting rights exert control. We found that the AST results are robust to this alternative assumption.

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**Table V**
**Investors Who Report High Percentages of Shares with "No" Voting Rights**

This table displays well-known institutional investors who report high percentages of airline shares for which they do not hold voting rights in the Refinitiv 13F database. For each investor, the table breaks down the fraction of shares reported as "sole," "shared," and "no" voting rights.

| Voting Rights Designation: | Sole | Shared | No |
|---|---|---|---|
| Old Lane | 0.0% | 0.0% | 100.0% |
| Gilder, Gagnon, Howe & Co. | 3.2% | 0.0% | 96.8% |
| Fidelity | 8.1% | 0.7% | 91.2% |
| PRIMECAP Management | 21.2% | 0.1% | 78.6% |
| T. Rowe Price | 24.8% | 0.0% | 75.2% |
| Vanguard Group | 26.5% | 2.3% | 71.2% |
| Selz Capital | 35.2% | 0.0% | 64.8% |
| Capital Research Global Investors | 49.5% | 2.4% | 48.1% |
| Wellington Management | 45.7% | 7.7% | 46.6% |
| U.S. Trust Company | 55.8% | 1.7% | 42.5% |

teams of each institution. Consequently, reporting is somewhat arbitrary and is inconsistent both across institutional investors and within an institution over time.[23] For example, prior to September 2005, the Vanguard Group characterized all of the shares it owned as having sole voting rights. However, since September 2005, it has reported all shares owned as having no voting rights. This change was not prompted by any SEC change in guidelines, but rather was the result of a unilateral decision by the Vanguard Group.[24] State Street Corporation provides another illustrative example. State Street reported a mix of shares with and without sole voting rights prior to the first quarter of 2004 and then designated all shares owned as having sole voting authority over the remainder of the sample period (the reverse of Vanguard's switch). To illustrate these inconsistencies, Figure 3 plots, for a subsample of institutions in our data, the percent of shares designated with sole and with no voting rights for each year-quarter in our sample. The volatility in voting designations reported both across funds and within a given fund over time can be seen in this figure.

Table V lists institutional investors, including well-known institutions such as Fidelity, T. Rowe Price, Vanguard, and Wellington, that report high percentages of shares owned that are designated as having no voting rights during our sample period. For example, over the entire 2001 to 2014 period, Fidelity reports no voting rights associated with over 90% of its airline shares and Vanguard reports no voting rights for over 70% of their shares (after 2005, this percentage increases to 100). Based on informal discussions with representatives from a few of these large institutions, we believe that shares

[23] This was also confirmed to us in informal discussions with SEC economists and the corporate governance teams of two large asset management firms.

[24] We examined voting designations for other large institutional investors and did not find significant changes in how these institutions designated voting authority in late 2005.

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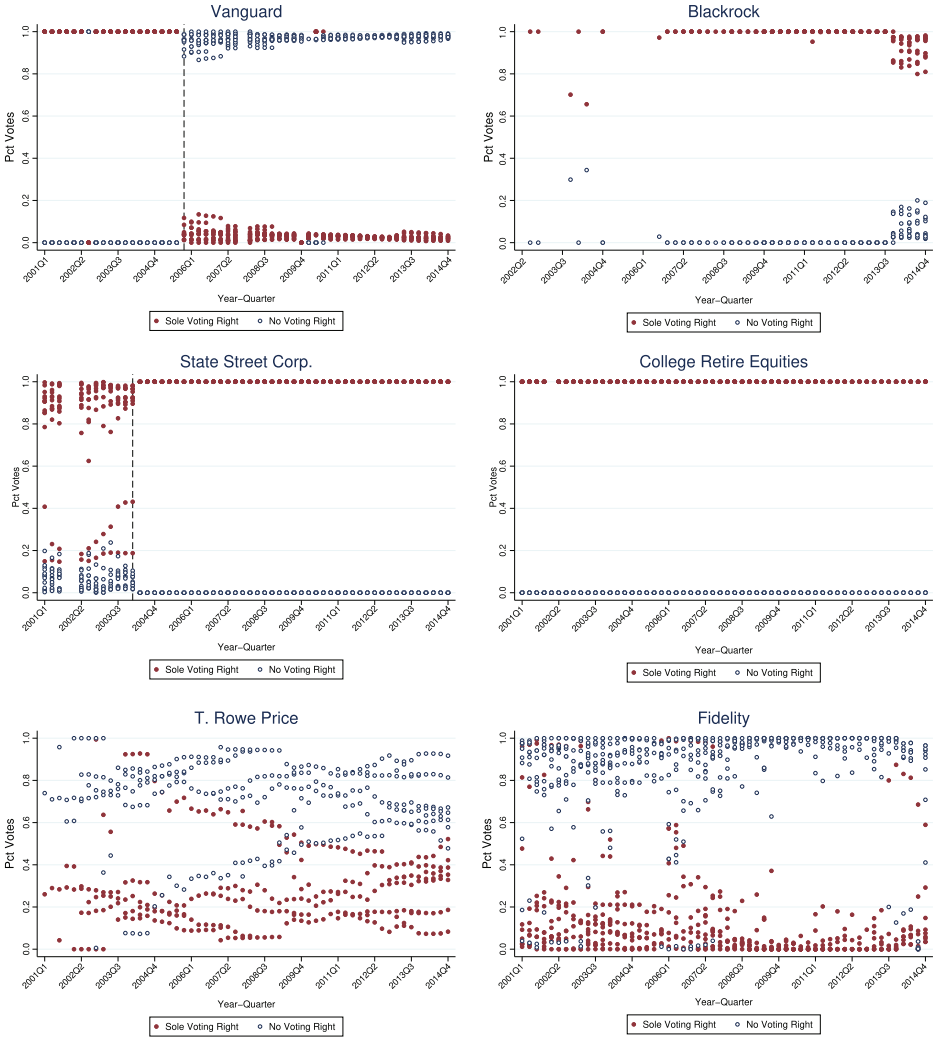


**Figure 3. Measuring control rights: Different voting designations.** For a subsample of institutions in our data set, we plot the percent of shares designated as "sole," as well as those with "no" voting right, as a fraction of all shares owned, for each year-quarter observation in our sample. The inconsistencies reported across funds and within a fund over time are consistent with SEC officials noting that the "Special Instruction 12.b.viii to Form 13F" guidelines are vague, with reporting depending on how each institution interprets the guidelines. For instance, Vanguard switched to designating all shares owned as having no voting right in the third quarter of 2005 while State Street reported some shares as having sole, others as no, voting authority prior to the first quarter of 2004, after which it designated all shares as having sole voting authority (the reverse move of Vanguard's). (Color figure can be viewed at wileyonlinelibrary.com)

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designated as having no voting rights are being misreported and/or misinterpreted, as the institutions could, in fact, be voting the shares. For example, individual funds within the Vanguard fund family report no voting rights for the shares they hold because voting does not happen at the fund level. Instead, each fund delegates its votes to the Vanguard institution, which then votes all of the shares held throughout the different funds in Vanguard. Hence, though it appears as if no fund in Vanguard votes the shares it owns, the fact is that Vanguard does vote those shares.

Even if institutions do not vote a large allocation of the shares they own, they can still influence management through voice by engaging in a number of actions that do not involve voting. McCahery, Sautner, and Starks (2008) document that shareholders report several such actions, including communication between shareholders and firm managers, discussions between shareholders and board members outside management, publicly criticizing management in the media, criticizing management and the board at the annual shareholders meeting, submitting shareholder proposals for the proxy statement, and aggressively questioning management on a conference call. These actions are available to *all* shareholders, including those owning shares designated with no voting rights. By narrowly defining control using only shares reported as having sole or shared voting power, the AST analysis explicitly ignores these venues of control through voice.

## IV. Further Evidence of Fragility

In this section, we analyze the robustness of the AST results to a data measurement issue and an econometric concern. The measurement issue involves the treatment of missing equity ownership and control data for bankrupt airlines. The econometric concern focuses on the inclusion of regression weights in all pricing regressions.

### *A. Ownership and Control of a Bankrupt Firm*

When airline $j$ operates under bankruptcy protection, investor $i$'s cash-flow and voting rights in $j$ ($\beta_{ij}$ and $\gamma_{ij}$, respectively) are not reported in SEC Form 13F and hence are missing from the Refinitiv database. This is a significant issue as virtually every legacy airline filed for bankruptcy at some point during the sample period (2001:Q1 to 2014:Q4), and at least one carrier operated under bankruptcy in over half of the year-quarters in the sample. Table VI lists airlines that declared bankruptcy during this time frame and provides bankruptcy filing and exit dates.

To address this missing data issue, AST carry an airline's prebankruptcy equity shares and reported voting designations forward through the quarters in which it operates in bankruptcy. Specifically, the authors state that

> Holdings are not observed during bankruptcy periods. During the bankruptcies of American Airlines, Delta Airlines, Northwest Airlines,

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**Table VI**

## Chapter 11 Bankruptcy Reorganization

This table reports the dates during which an airline operated under Chapter 11 Bankruptcy protection during our sample period (2000:Q1 to 2014:Q4), and the distribution (recovery) that prebankruptcy equity holders received when the carrier exited from bankruptcy (column (5)). Figure IA.2 in the Internet Appendix presents an excerpt of a disclosure statement for United Airlines. Data for the first bankruptcy of US Airways are from Court Listener, accessed May 2019, https://www.courtlistener.com/opinion/2014491/in-re-us-airways-group-inc/.

Bankruptcy Dates and Distribution for Interests (Equity) upon Reorganization

| Carrier | Bankruptcy Dates | | Emerging from Bankruptcy | | | |
|---|---|---|---|---|---|---|
| | | | Document | Page(s) | Date | Distribution |
| | Filed | Emerged | | | Reported | to Interests |
| United Airlines | 12/9/02 | 2/2/06 | SEC Form 8-K | 3 to 5 | 1/20/06 | 0 |
| US Airways | 8/11/02 | 3/31/03 | Court Listener | | | 0 |
| US Airways | 9/12/04 | 9/27/05 | SEC Form 10-K | 17 | 3/15/2006 | 0 |
| Delta | 9/14/05 | 4/24/07 | Disclosure Statement | | 12/19/06 | 0 |
| Northwest | 9/14/05 | 5/18/07 | SEC Form 8-K | 5 and 24 | 5/21/07 | 0 |
| Mesa | 1/5/10 | 1/3/11 | 3rd Amended Joint Plan of Reorganization | 1, 32, and 36 | 1/19/11 | 0 |
| American Airlines | 11/29/11 | 12/8/13 | AMR & US Airways Merger: Information for AMR Investors | 3 | 8/15/13 | 3.5% of new equity in merged carrier |

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> United Airlines, and US Airways, we repeat the last observed value for percentage of shares owned. (p. 1525)

This imputation method explicitly assumes that shareholders of a bankrupt carrier retain their cash flow rights and continue to exert control over management, while the firm operates in bankruptcy. Consequently, prebankruptcy shareholders continue to contribute to the measure of common ownership, just as they did before the bankruptcy filing. This assumption is problematic, since the reason equity holdings in an insolvent carrier are not observed during bankruptcy is likely that they concede ownership and control to creditors.

One possible justification for carrying forward investors' prebankruptcy ownership and control throughout the bankruptcy period is that managers of bankrupt airlines may anticipate that prebankruptcy equity holders will receive shares in the restructured firm if and when the carrier exits bankruptcy. If so, managers might feel beholden to the *pre*-bankruptcy owners and concede some control to them during bankruptcy. To evaluate this possibility, we search the "Bankruptcy Disclosure Statement" of each bankrupt carrier for the distributions that prebankruptcy equity holders received in the court-approved reorganization plans.[25] Table VI presents the findings. In all cases except the American Airlines bankruptcy, equity holders recovered nothing. In the case of American Airlines, only 3.5% of its newly issued, postbankruptcy shares were allocated to the prebankruptcy equity holders (a very diluted distribution to any single prebankruptcy shareholder). We thus find little empirical evidence to support the idea that airline managers might feel beholden to prebankruptcy equity holders in anticipation of them receiving a positive recovery rate.[26]

AST recognize that this is an important issue and conduct a few robustness checks to see if the pricing results are sensitive to the treatment of bankruptcy periods. In the primary exercise, AST eliminate from their sample all year-quarters in which a major airline operated in bankruptcy. This includes dropping markets served exclusively by nonbankrupt carriers during those year-quarters, which reduces the sample of markets by more than 50%. The estimated relationship between $HHI\Delta$ and prices remains positive and statistically significant, which AST interpret as evidence that the results are not driven by bankrupt airlines.[27] A second exercise discussed in the paper retains only market-carrier observations in which the airline was operating in bankruptcy. This reduces the sample of market carriers by almost 90%.

[25] See Internet Appendix Figure IA.2 for an excerpt of United Airline's 8-K "Bankruptcy Disclosure Statement" showing the allocation given to prebankruptcy equity holders when the firm exits bankruptcy.

[26] To address the unique case of American Airlines' (AA) Reorganization plan, which allocated 3.5% of AA's newly issued postbankruptcy shares to the prebankruptcy equity holders, we construct three new $HHI\Delta$ measures, including one that "carries back" ownership assuming that investors perfectly forecast a recovery of 3.5% of AA's postbankruptcy outstanding shares. Details are discussed and results are reported in Section VI of the Internet Appendix. Table IA.V shows that our results are not sensitive to the unique features of AA's exit plan.

[27] The results of this exercise are displayed in Table IV, column (1) in AST.

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The estimated relationship between prices and common ownership becomes small and statistically insignificant for this subsample. Based on these exercises, along with some additional tests in the paper's Internet Appendix, AST conclude that the treatment of bankruptcy is not important for their main results.[28]

While these exercises suggest that the AST results are robust to the omission of bankruptcy periods, and are weaker in the subsample of market-carrier observations corresponding exclusively to bankrupt carriers, they do not directly address the changes that a bankruptcy filing introduces to the cash-flow rights and control of existing equity holders. This is an important consideration when studying common ownership effects as these changes impact the extent of common ownership, and hence potentially its correlation with ticket prices. To address this concern, we construct three alternative measures of $HHI\Delta$, each accounting for different ways in which shareholders' cash-flow rights and control could change during bankruptcy (lose both cash-flow rights and control, lose cash-flow rights only, or lose control only). We then reestimate the AST pricing regressions for each version of $HHI\Delta$.

Our first alternative to the AST assumption of carrying forward investors' prebankruptcy ownership and control is based on the idea that a forward-looking manager may anticipate fiduciary duties to *post*-bankruptcy equity holders. For example, a manager may expect that certain shareholders who are wiped out in bankruptcy will purchase postbankruptcy shares (e.g., index funds), and consequently, may feel beholden to *post*-bankruptcy equity holders.[29] Based on this idea, we construct the alternative measure $HHI\Delta^{Ctrl\ After}_{Own\ After}$, which carries the postbankruptcy allocation of equity shares backward through the bankruptcy period.

The second measure, $HHI\Delta_{Not\ Own}$, sets ownership values, $\beta_{ij}$, to zero during bankruptcy periods. This is our preferred assumption as it is consistent with the bankruptcy literature, which finds that equity holders largely concede cash-flow rights to creditors, as creditors become the residual claimants of bankrupt firms. Silberglied (2015), for example, states that "[w]hen a corporation is insolvent … its creditors take the place of the shareholders as the residual beneficiaries of any increase in value" (p. 194). When an equity holder $i$ loses cash-flow rights in firm $j$ ($\beta_{ij} = 0$), $i$ ceases to contribute to common ownership in the markets that $j$ operates, regardless of whether $i$ retains any control in firm $j$. Thus, we can be agnostic about equity holders' control during

[28] Table IA.I in the AST Internet Appendix displays results from additional regressions in which AST stratify their sample by *markets* with at least one bankrupt carrier and those with no bankrupt carriers. Both exercises yield large, positive, statistically significant $HHI\Delta$ coefficients, although the magnitude of the coefficient is slightly smaller in the markets with a bankrupt carrier.

[29] We thank an anonymous referee for this idea.

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bankruptcy when we assume that investor cash-flow rights are zero during this time.[30]

The third measure, $HHI\Delta^{No\ Ctrl}_{Own\ Before}$, sets investor $i$'s control in bankrupt firm $j$, $\gamma_{ij}$, to zero during bankruptcy, but assumes, as in the AST analysis, that prebankruptcy shareholders retain cash-flow rights. This assumption does not completely eliminate investor $i's$ contribution to common ownership in the markets that $j$ operates, but it does lower $i's$ contribution.[31] In addition, $HHI\Delta^{No\ Ctrl}_{Own\ Before}$ empirically captures the following statement in AST:[32]

> Bankruptcies may confound the results because shareholders have no de jure control rights during such times. (p. 1530)

Table VII, Panels A and B, report estimates from market-carrier- and market-level regressions (2) and (3), respectively, using each of these alternative measures of common ownership. For ease of comparison, we report the AST results that assume prebankruptcy ownership and control, $HHI\Delta^{Ctrl\ Before}_{Own\ Before}$, in column (1) of each panel. Column (2) displays results using $HHI\Delta^{Ctrl\ After}_{Own\ After}$. The magnitude of the $HHI\Delta$ coefficient falls by about one-third (from 0.147 to 0.097) in the market-carrier-level regression and by about 20% (from 0.197 to 0.159) in the market-level regression, but in both specifications, the coefficient estimate remains statistically significant. Column (3) shows estimates for $HHI\Delta_{Not\ Own}$. In both market-carrier- and market-level regressions, the $HHI\Delta$ coefficient declines substantially in magnitude and loses its statistical significance. In the market-carrier- and market-level specifications, the estimates fall from 0.147 to 0.037 and from 0.197 to 0.070, respectively. Finally, in column (4), we report estimates for $HHI\Delta^{No\ Ctrl}_{Own\ Before}$. In the market-carrier-level regressions, the $HHI\Delta$ coefficient falls from 0.147 to a statistically insignificant 0.050. This is consistent with the results documented in Egland et al. (2020), who also focus on the alternative measure, $HHI\Delta^{No\ Ctrl}_{Own\ Before}$

[30] Assuming that equity holders have pre- or postbankruptcy control, or have no control at all, $\gamma_{ij} >= 0$, does not change the value of $HHI\Delta$. Section V of the Internet Appendix shows the derivation of this result.

[31] Table IA.II in the Internet Appendix summarizes the different versions of $HHI\Delta$.

[32] This is not our most favored assumption as our interpretation of the bankruptcy literature is that the extent of control in a bankrupt firm is more ambiguous than the allocation of cash-flow rights, as fiduciary duties of insolvent firms are owed to *both* equity holders and creditors, while cash-flow rights are owed to creditors. The literature recognizes that a major function of corporate bankruptcy is a shift in control away from equity to creditors, even if fiduciary duties are owed to all stakeholders. Skeel (2004) argues that equity holders retain very limited rights in an insolvent firm as the most important aspect of control during bankruptcy—access and control over the firm's cash—is granted to creditors who then have significant influence over the bankruptcy outcome. In fact, Ayotte and Morrison (2009) find that covenants in debtor in possession (DIP) loans grant creditors tight control over a bankrupt firm in the form of line-item budgetary control over the debtor's operations. Based on the Ghewalla Case, Silberglied (2015) states that "When a corporation becomes insolvent, directors continue to owe a fiduciary duty to the corporation as a whole" (p. 189). However, Silberglied (2015) concludes that whether the directors should act in the best interests of creditors or in the best interest of the firm makes little difference, since the residual beneficiaries of a bankrupt firm are the creditors.

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**Table VII**

## Ownership and Control Through Bankruptcy

This table presents results reestimating AST's market-carrier and market-level regressions using alternative measures of $HHI\Delta$, with each one corresponding to a different assumption regarding who owns and controls a firm that operates under Chapter 11 Bankruptcy. Panels A and B report market-carrier- and market-level regressions, respectively. Columns (1) in both panels correspond to AST's specification, which carries the prebankruptcy ownership and control forward through the bankruptcy quarters, $HHI\Delta^{Ctrl\ Before}_{Own\ Before}$. Column (2) presents results using $HHI\Delta^{Ctrl\ After}_{Own\ After}$, constructed by carrying the first postbankruptcy reported shares backward through the bankruptcy quarters. Column (3) presents results using $HHI\Delta_{Not\ Own}$, constructed setting cash-flow rights to zero through the bankruptcy quarters (these results hold whether we set control to zero or to prebankruptcy levels since $HHI\Delta^{Yes\ Ctrl}_{Not\ Own} = HHI\Delta^{No\ Ctrl}_{Not\ Own}$). Column (4) present results using $HHI\Delta^{Not\ Ctrl}_{Yes\ Own}$, constructed setting cash-flow rights at the prebankruptcy level and voting rights to zero through the bankruptcy period. Robust standard errors, in parentheses, are clustered by year-quarter and market-carrier (Panel A) and market (Panel B). Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Panel A: Market-Carrier-Level Regressions

| | Pre-Bkt Own & Ctrl Forward (1) | Post-Bkt Own & Ctrl Backwards (2) | No Ownership No (or Yes) Control (3) | Yes Ownership No Control (4) |
|---|---|---|---|---|
| $HHI\Delta$ | 0.147*** | 0.097** | 0.037 | 0.050 |
| | (0.038) | (0.043) | (0.044) | (0.047) |
| HHI | 0.163*** | 0.150*** | 0.133*** | 0.136*** |
| | (0.021) | (0.022) | (0.021) | (0.022) |
| Log(Distance) x Yr-Qtr FE | x | x | x | x |
| Full Set of Controls | x | x | x | x |
| Yr-Qtr FE | x | x | x | x |
| Market-Carrier FE | x | x | x | x |
| $R^2$ | 0.84 | 0.84 | 0.84 | 0.84 |
| # Observations | 1,209,791 | 1,209,791 | 1,209,791 | 1,209,791 |
| # Market-Carriers | 45,244 | 45,244 | 45,244 | 45,244 |

(*Continued*)

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**Table VII**—*Continued*

| Panel B: Market-Level Regressions | | | | |
|---|---|---|---|---|
| | Pre-Bkt Own & Ctrl Forward (1) | Post-Bkt Own & Ctrl Backwards (2) | No Ownership No (or Yes) Control (3) | Yes Ownership No Control (4) |
| *HHI*Δ | 0.197*** | 0.159*** | 0.070 | 0.093* |
| | (0.037) | (0.043) | (0.044) | (0.047) |
| HHI | 0.256*** | 0.245*** | 0.218*** | 0.225*** |
| | (0.025) | (0.026) | (0.026) | (0.026) |
| Log(Distance) x Year-Quarter FE | x | x | x | x |
| Full Set of Controls | x | x | x | x |
| Year-Quarter FE | x | x | x | x |
| Market-Carrier FE | x | x | x | x |
| $R^2$ | 0.88 | 0.88 | 0.88 | 0.88 |
| # Observations | 255,173 | 255,173 | 255,173 | 255,173 |
| # Markets | 6,911 | 6,911 | 6,911 | 6,911 |

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(Table I, column (3) in that paper). In the market-level regressions, the $HHI\Delta$ coefficient falls from 0.197 to a marginally significant 0.093.

In Section V of the Internet Appendix, we delve further into the mechanism that drives the results in Table VII. Specifically, we show that assigning positive ownership and control values to shareholders of bankrupt firms inflates $HHI\Delta$, and it does so precisely in markets that naturally exhibit higher prices due to higher demand for air travel (as captured by higher income and population at the endpoints of the market). This drives the positive correlation between the $HHI\Delta^{Ctrl\ Before}_{Own\ Before}$ and $HHI\Delta^{Ctrl\ After}_{Own\ After}$ measures of common ownership and prices.

In summary, the relationship between $HHI\Delta$ and ticket prices is sensitive to assumptions about how much ownership and control over the airline is retained by shareholders during bankruptcy periods. As an alternative to AST's approach of deleting all quarters during which at least one carrier is bankrupt, we retain data for all quarters in the sample and investigate the effect of plausible alternative assumptions for assigning cash-flow rights and control during bankruptcy. If we assume that prebankruptcy investors lose either cash-flow rights or control over the airline in bankruptcy, then the positive and statistically significant $HHI\Delta$ coefficient documented in AST is significantly attenuated.

### *B. The Effect of Regression Weights*

AST weight all pricing regressions by average passenger counts. The authors justify this choice based on a previous paper in the literature:

> Following Goolsbee and Syverson (2008), we weight the market-carrier level regressions by average passengers for the market and carrier over time. (p. 14)

While AST offer no further justification for using regression weights in this context,[33] we offer sample selection and economic arguments that can potentially justify their use in this context. From a statistical perspective, there are typically three reasons for estimating weighted regressions according to Cameron and Triverdi (2008), Cameron and Trivedi (2010), and Solon et al. (2015). We review these in detail in Section VII of the Internet Appendix, where we conclude that none of them apply to the current setting.[34] From

[33] (Goolsbee and Syverson, 2008, p. 1617) justify their choice since doing so "allows us to measure the 'aggregate' responses to Southwest's entry (and is particularly important when we look at passenger volume responses, because logged passenger numbers are particularly volatile on low-traffic routes)." The AST analysis focuses on price responses not volume responses, and thus, it is not clear why the rationale for including weights applies in the AST context.

[34] With the exception of Goolsbee and Syverson (2008), the literature on airline pricing and market structure that uses the DB1B database does not employ regression weights. See, for instance, Borenstein (1989), Berry (1990a), Borenstein and Rose (1994), Borenstein and Rose (2003), Gerardi and Shapiro (2009), Ciliberto and Schenone (2012b), Snider and Williams (2015), and Ciliberto et al. (2019)).

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**Table VIII**
**The Effect of Using Regression Weights**

This table presents results from estimating the AST specification with and without regression weights based on passenger counts. Columns (1) and (2) display results at the market-carrier level. Columns (3) and (4) display similar results at the market level. Robust standard errors, in parentheses, are clustered by year-quarter and market-carrier (columns (1) and (2)) and market (columns (3) and (4)). Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

| | Market-Carrier-Level Regressions | | Market-Level Regressions | |
|---|---|---|---|---|
| | Weights | No Weights | Weights | No Weights |
| | (1) | (2) | (3) | (4) |
| *HHI*Δ | 0.147*** | 0.045** | 0.197*** | 0.149*** |
| | (0.038) | (0.022) | (0.037) | (0.026) |
| *HHI* | 0.163*** | 0.193*** | 0.256*** | 0.221*** |
| | (0.021) | (0.013) | (0.025) | (0.019) |
| Log(Distance) · Yr-Qtr FE | x | x | x | x |
| Full Set of Regressors | x | x | x | x |
| Year-Quarter FE | x | x | x | x |
| Market-Carrier FE | x | x | x | x |
| Regression Weights | x | | x | |
| # Observations | 1,209,791 | 1,209,791 | 255,173 | 255,173 |
| $R^2$ | 0.84 | 0.61 | 0.88 | 0.84 |
| # Market-Carriers | 45,244 | 45,244 | | |
| # Markets | | | 6,911 | 6,911 |

an economic perspective, we offer two possible justifications. First, since the weights are based on passenger counts, their inclusion places more emphasis on high-volume, heavily trafficked, markets. Focusing efforts to promote cooperation and anticompetitive behavior with rivals in these markets could be justified if they are also the most profitable ones. However, while more passengers yield higher revenue, operating costs on high-volume routes may also be higher, casting doubt on whether these are, in fact, the most profitable markets. Without data on costs and average markups at the market level, it is not clear that focusing on heavily trafficked routes results in higher gains for institutional investors. The second, more plausible, economic rationale for the use of regression weights entails regulators concerned with the effect of common ownership on consumer welfare. Specifically, regulators might consider the extent of consumers adversely affected by the alleged anticompetitive behavior of common owners, justifying the focus on high-volume markets.

To understand the impact of using regression weights, we reestimate the pricing regressions without weights. Results are reported in Table VIII. For comparison purposes, columns (1) and (3) reproduce results from the most

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saturated specification of the AST analysis at the market-carrier and market levels, respectively. Columns (2) and (4) display results with no passenger weights. In the market-carrier-level regressions, the magnitude of the effect of $HHI\Delta$ on average fares declines by almost 70% from 0.147 to 0.045. The impact of regression weights is less severe in the market-level regressions as the coefficient drops almost 25% from 0.197 to 0.149.[35]

## V. Other Data Issues

In this section, we briefly address two issues concerning data construction that played more prominent roles in earlier versions of this paper. First, we discuss how AST aggregate ownership and control across funds within a fund family and the effect of doing so on the results. Second, we discuss the sample filters that AST apply to clean the raw airline data and how more conventional sample restrictions impact the results.

### *A. The Effect of Aggregating Ownership and Control to the Fund Family Level*

AST aggregate ownership and control rights held by each fund to the fund family level. However, it is unclear whether such aggregation is justified, and if so, how it should be done. Section VIII of the Internet Appendix discusses these concerns, and presents results showing that the estimated relationship between $HHI\Delta$ and ticket prices is not materially affected by whether we aggregate ownership and control across funds in a family, do not aggregate at all, or use an aggregation strategy different from that in the AST analysis (Table IA.VII). This finding is consistent with our argument that it is the time-series variation in market shares (and not in ownership) that identifies the coefficient on $HHI\Delta$, as changing the ownership component of $HHI\Delta$ results in coefficient estimates that are largely unchanged.

### *B. The Effect of Alternative Airline Ticket Filters*

AST apply a series of sample restrictions to the raw airline ticket data that are unusual compared to those used in the existing airline pricing literature.[36] We test the robustness of the AST results to the more conventional filters applied to airline ticket data. Section IX of the Internet Appendix presents results from estimating the most saturated regression specification, with and

[35] Internet Appendix Section VII shows that high-volume markets drive the AST pricing results. We estimate the primary AST pricing regressions for different subsamples, each corresponding to a different percentile of the quarterly distribution of market-carrier passenger counts and market-level passenger counts. We find that below the 95$^{th}$ percentile of the passenger distribution, the relationship between $HHI\Delta$ and average fares is economically small and only marginally significant. Results are strongest in the top 5$^{th}$ percentile of the passenger count distribution.

[36] See, for instance, Borenstein (1989), Berry (1990b), Borenstein and Rose (2003), Bushee (2001), Rupp et al. (2006), Gerardi and Shapiro (2009), Ciliberto and Schenone (2012a), and Snider and Williams (2015).

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without regression weights, for different samples, each one corresponding to the application of a specific filter when building the airline data (Table IA.X). Overall, implementing alternative sample filters does not significantly affect the $HHI\Delta$ coefficient estimate.

## VI. Conclusion

In this paper, we revisit the empirical evidence on the relationship between ticket prices and common ownership in the airline industry, as described in Azar, Schmalz, and Tecu (2018), and documents several new results. First, we implement a placebo analysis that shows that the positive effect of the measure of common ownership, $HHI\Delta$, on average airline prices is identified by variation in airline market shares rather than variation in institutional ownership and control. This finding casts significant doubt on the widespread interpretation of the AST finding that common ownership leads to anticompetitive effects in the airline industry.

In addition, we show that reasonable alternative assumptions regarding the mapping of voting designations to investor control, the treatment of ownership and control in periods of bankruptcy, and the use of regression weights that emphasize high-volume markets significantly weaken and sometimes completely eliminate the positive correlation between the measure of common ownership and average ticket prices.

Taken together, these results suggest that AST's conclusion that common ownership exerts a causal anticompetitive effect on ticket prices in the airline industry is unwarranted. Furthermore, the results suggest that the AST findings should not be used as a basis for regulation that would limit asset management consolidation with the objective of protecting consumer surplus.

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**Appendix S1:** Internet Appendix.
**Replication Code.**

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