# Outsourcing and Price Competition: An Empirical Analysis of the Partnerships between Legacy Carriers and Regional Airlines*

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**Abstract**

This paper investigates the determinants and competitive effects of legacy carriers' outsourcing decision with independent regional airlines. Legacy carriers allocate a larger share of their operations to an independent regional airline partner compared to their own fleet or a wholly owned regional airline on routes that experience stronger competition, particularly from low-cost carriers. Moreover, legacy carriers' airfares are lower on routes that they outsource more prominently to an independent regional airline. The results suggest that increased route competition is a motivation for the growing use of independent regional airlines by legacy carriers.

**JEL classifications**: L93, L24
**Keywords**: Outsourcing, Legacy Carriers, Regional Airlines, Low-Cost Carriers, Airfares

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# 1 Introduction

Although Coase (1937), Williamson (1985), and Grossman and Hart (1986) provide seminal papers that study the role of incomplete contracts and transactions costs on a firm's decision to outsource the production of inputs, more recent theoretical work explores the competitive motivations for outsourcing. For example, Sappington (2005) theorizes that a telecommunications firm's decision to build its own network or buy key inputs from a competitor need not reflect the level of the input prices but instead depends on who has a cost advantage. Moreover, Cachon and Harker (2002) provides a theoretical model that shows how outsourcing is particularly attractive for firms that experience economies of scale. Empirical papers explore the role of firm-specific assets (Coles and Hesterly, 1998) and essential inputs (Beard, Ford, and Koutsky, 2005) as determinants in a firm's make-or-buy decision. This paper provides empirical evidence of competition as an alternative motivation for a firm to outsource.

In the airline industry, legacy carriers have recently become more reliant on independent regional airlines to provide service for passengers within their route network.[1] Under these outsourcing arrangements, planes are owned by the regional airlines, but are painted to resemble the legacy carrier's fleet. Flight crews are employed by the regional airline, yet the legacy carrier is responsible for ticketing and operations at the airport.

This paper uses a reduced-form regression model to assess the competitive effect of the outsourcing partnerships between legacy carriers and their regional airline partners. One way this paper addresses this issue is by investigating the circumstances under which a legacy carrier decides to have a route served by an independent regional airline instead of its own fleet or a wholly owned regional airline. The regression results suggest that legacy carriers tend to allocate the operation of more competitive routes to an independent regional airline. In other words, legacy carriers

[1] Legacy carriers are major airlines that existed prior to industry deregulation in 1978. The "Big Six" legacy carriers studied in this paper are American Airlines, Continental Airlines, Delta Air Lines, Northwest Airlines, United Airlines, and US Airways.

increase the amount of outsourcing on routes that experience stronger competition.

Second, I analyze the legacy carriers' pricing behavior that is associated with this outsourcing decision. On this note, I find that legacy carriers set a lower average airfare, 10th percentile airfare, and 90th percentile airfare on routes that are operated by an independent regional airline.

The papers that are most closely related to this paper are Forbes and Lederman (2009, 2010), which both analyze the legacy carriers decision to use either an independent regional airline or a wholly owned regional airline. First, Forbes and Lederman (2009) find that legacy carriers are more likely to operate with a wholly owned regional airline on routes that are more integrated with the legacy carrier's route network and are more susceptible to adverse weather conditions. Moreover, Forbes and Lederman (2010) find that service quality, as measured by on-time performance and cancellations, improve when using a wholly owned regional airline as opposed to an independent regional airline.

This paper differentiates from the work done by Forbes and Lederman by providing an alternative reason why legacy carriers would want to outsource the operation of a route to their regional airline partners. In particular, I focus on how upstream competition between legacy carriers and rival airlines − particularly low-cost carriers (LCCs) − influence the partnerships between legacy carriers and independent regional airlines. As such, this paper complements the findings in the existing literature on the relationship between legacy carriers and regional airlines.

# 2 Data

The dataset used in this paper is primarily derived from the Airline Origin and Destination Survey (DB1B), which is published quarterly by the U.S. Bureau of Transportation Statistics. It is a ten percent survey of domestic air travel and contains data on the origin, destination, non-

stop distance between endpoints, ticketing and operating carrier,[2] market fare,[3] and number of passengers that pay a particular market fare. Dates when legacy carriers were protected under Chapter 11 bankruptcy are obtained from public sources. Annual population and per capita income at the metropolitan statistical area (MSA) level are provided by the U.S. Bureau of Economic Analysis. Finally, annual reports published by the Regional Airlines Association, an industry trade group, lists the partnerships between legacy carriers and independent regional airlines and are summarized in Table 1.[4] The sample time period for this paper is 1998 to 2015.

The following steps are undertaken to clean the data. First, I eliminate observations where the distance is equal to zero or the ticketing carrier is unidentified. Observations that pertain to a one-way market fare that is either less than $50 or greater than $1,000 are also dropped. Only observations that are related to coach fares on nonstop flights are kept.[5] I then limit the sample to routes within the contiguous United States with a maximum distance of 1,500 miles since regional airlines would not be used on longer routes and restrict the sample to the 2,500 routes with the highest number of passengers from 1998 to 2015. An observation in the resulting dataset is at the carrier-route-year-quarter level.

Legacy carriers have become more attracted to partnering with regional airlines in part because regional airlines benefit from relatively lower costs. For example, Hirsch (2007) found that senior pilots and flight attendants at United Airlines make 80 percent more and 32 percent more,

[2]The key distinction between the ticketing carrier and the operating carrier is that the ticketing carrier is the airline that the passenger purchased the ticket from, whereas the operating carrier is the airline that is in charge of the aircrew and fleet that are used on the flight.

[3]Market fare is calculated by the U.S. Bureau of Transportation Statistics as the itinerary yield multiplied by the number of miles flown. Ancillary fees − such as baggage fees, priority seating fees, and the cost of food and beverage purchased on the flight − are not accounted for in the market fare.

[4]Since this paper focuses on the legacy carriers' outsourcing decision with their independent regional airline partners, wholly owned regional airlines are not reported in Table 1.

[5]It can be the case that regional airlines are flying travelers on one leg of a one-stop or multi-stop itinerary. However, the issue with these itineraries is that a legacy carrier can be responsible for a portion of the one-stop or multi-stop itineraries as well. In other words, I focus on nonstop products in order to avoid the complication with some passengers flying on a legacy carrier plane to get them from a origin airport to a hub airport and then a regional airline from the hub airport to the final destination airport. Thus, a focus on nonstop products provides a cleaner analysis of the legacy carrier's decision to operate that particular route itself or with an independent regional airline.

Table 1: Legacy Carrier Partnerships with Independent Regional Airlines

| Legacy Carrier | Independent Regional Airline |
|---|---|
| American Airlines | Air Wisconsin |
| | Chautauqua Airlines |
| | Compass Airlines |
| | Mesa Airlines |
| | SkyWest Airlines |
| | Trans States Airlines |
| Continental Airlines | Chautauqua Airlines |
| | Colgan Air |
| | Commutair |
| | SkyWest Airlines |
| Delta Air Lines | Atlantic Coast Airlines |
| | Chautauqua Airlines |
| | Compass Airlines |
| | Mesaba Airlines |
| | Shuttle America |
| | SkyWest Airlines |
| Northwest Airlines | Compass Airlines |
| | Mesaba Airlines |
| United Airlines | Air Wisconsin |
| | Atlantic Coast Airlines |
| | Chautauqua Airlines |
| | Colgan Air |
| | Commutair |
| | ExpressJet Airlines |
| | GoJet Airlines |
| | Great Lakes Airlines |
| | Gulfstream International Airlines |
| | Mesa Airlines |
| | Shuttle America |
| | SkyWest Airlines |
| | Trans States Airlines |
| US Airways | Air Midwest |
| | Air Wisconsin |
| | Colgan Air |
| | Chautauqua Airlines |
| | Mesa Airlines |

respectively, than their counterparts at regional airlines. Moreover, Brueckner and Pai (2009) analyze how regional airlines have steadily replaced their turboprop aircraft with more cost efficient regional jets, which leads to lower operating costs. As a result, the use of regional airlines by

legacy carriers has drastically expanded over time as the total number of routes that legacy carriers operated with the use of independent regional airlines increased from 210 in 1998 to 2,035 in 2015.

Since regional airlines have a more efficient cost structure, then perhaps legacy carriers could consider operating all routes using their regional airline partners. However, scope clauses in labor union contracts between legacy carriers and their labor unions limit the amount of flights that the legacy carrier can operate using a regional airline. As discussed in both Forbes and Lederman (2007) and Rupp and Liu (2016), scope clauses typically take on one of two forms: 1) a cap on the total number of flights operated by a regional airline on behalf of a legacy carrier or 2) the legacy carrier must increase the number of flights that are flown by its own fleet by a pre-determined ratio for every increase in flights that are operated by regional airlines.

These scope clauses effectively create a trade-off for the legacy carrier when it decides which routes to allocate to its own fleet or to an independent regional airline partner. Interestingly, recent labor negotiations between legacy carriers and their labor unions have allowed legacy carriers to increase the number of flights that can be outsourced to independent regional airlines.

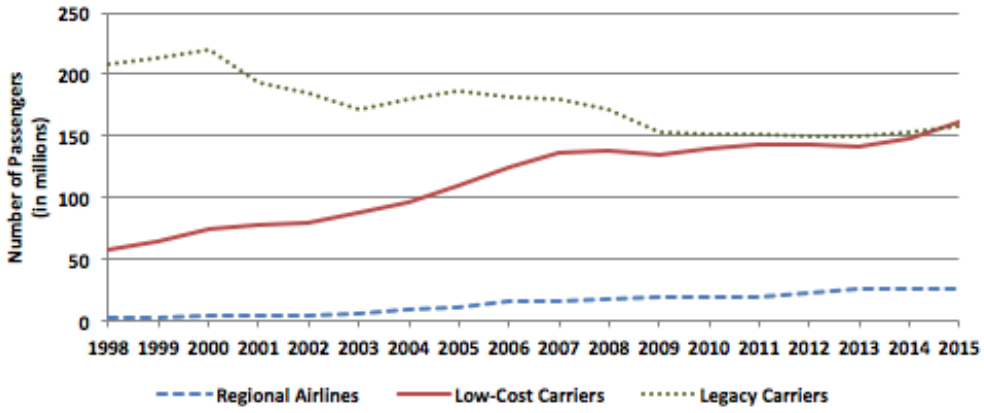


Figure 1: Number of Passengers Flown by Operating Carrier

The number of passengers is calculated based on whether the operating carrier was an independent regional airline, LCC, or legacy carrier. As such, the number of passengers is not determined by the ticketing carrier. For example, an independent regional airline would be credited for the number of passengers it flew on behalf of a legacy carrier. Legacy carriers get credit only for passengers who flew on flights that they operated using their own fleet or a wholly owned regional airline.

Figure 1 shows strong growth by independent regional airlines based on the data sample that is used in this paper. In fact, 208 million and 1.6 million passengers flew on flights that were operated by legacy carriers and independent regional airlines, respectively, in 1998. This corresponds to a market share of 77.6% for legacy carriers and 0.6% for independent regional airlines. While the number of passengers flown by legacy carriers decreased to 158 million passengers (45.8% market share) in 2015, 25.3 million passengers (7.3% market share) flew with an independent regional airline that operated on behalf of a legacy carrier. Since scope clauses have become less constrained over time, legacy carriers have been able to outsource more flights to regional airlines, which helps explain the growth of regional airlines, as is illustrated in Figure 1.

As with regional airlines, LLCs have experienced a remarkable growth in the number of passengers flown between 1998 and 2015.[6] These airlines get their name from their lower cost structure − which is typically measured in the industry as cost per available seat mile (CASM) − compared to legacy carriers due to the LCCs' lower labor costs, newer and more homogenous fleets, and more direct point-to-point route network.[7] Figure 1 illustrates that the number of passengers who have been flown by LCCs has increased dramatically: from 58.3 million (21.7% market share) in 1998 to 162 million (46.9% market share) in 2015. This paper studies how increased route competition − particularly from LCCs − has affected the growing use of independent regional airlines by legacy carriers.

# 3 Empirical Analysis

Legacy carriers could potentially charge lower prices by exploiting a regional airlines' more efficient cost structure. However, the legacy carrier's pricing strategy could be endogenous with its decision to operate a route using its own fleet or to outsource to an independent regional airline. In

[6]Following Kwoka, Hearle, and Alepin (2016), the five LCCs that are studied in this paper are: Allegiant Air, AirTran Airways, Frontier Airlines, JetBlue Airways, and Southwest Airlines.

[7]See Brueckner, Lee, and Singer (2013), Kwoka, Hearle, and Alepin (2016), and Rupp and Liu (2016) for more details on LCCs.

order to resolve these inherent endogeneity issues, I implement a two-stage regression model that takes advantage of the fact that the legacy carriers' capacity decision is based on lagged factors that also affect their pricing behavior.

The regression specification is as follows:

$$REGshare_{ij,t} = \beta_1 X_{ij,t-4} + \beta_2 competition_{j,t-4} + \gamma_t + \varepsilon_{ij,t} \quad (1)$$

$$lnPrice_{ij,t} = \delta_1 X_{ij,t} + \delta_2 competition_{j,t} + \delta_3 \widehat{REGshare}_{ij,t} + \eta_{ij} + \eta_t + \nu_{ij,t}. \quad (2)$$

Equation (1) refers to the first-stage regression of $REGshare_{ij,t}$ − the proportion of total route passengers ticketed through legacy carrier $i$ that flew with an independent regional airline on route $j$ in time $t$ − on: lagged measures of route competition ($competition_{j,t-4}$); other lagged control variables ($X_{ij,t-4}$); and year-quarter dummy variables ($\gamma_t$). As constructed, $REGshare_{ij,t} = 0$ means that legacy carrier $i$ is flying route $j$ wholly with its own planes and personnel in time $t$, whereas $REGshare_{ij,t} = 1$ is where an independent regional airline is entirely flying route $j$ on behalf of legacy carrier $i$ in time $t$. As such, a legacy carrier increases the amount of outsourcing when *REGshare* goes from 0 towards 1. Since $REGshare_{ij,t}$ is a continuous variable that is bounded between zero and one, Equation (1) is estimated using a two-sided Tobit regression.[8]

On the other hand, Equation (2) refers to the second-stage regression of $lnPrice_{ij,t}$ − the logged average one-way airfare set by legacy carrier $i$ for route $j$ in time $t$ − on: fitted values of $\widehat{REGshare}_{ij,t}$; contemporaneous measures of route competition ($competition_{j,t}$); other contemporaneous control variables ($X_{ij,t}$); as well as carrier-route fixed effects ($\eta_{ij}$) and year-quarter fixed effects ($\eta_t$).[9] Standard errors are clustered by carrier-route in both stages to account for heteroskedasticity and serial correlation between carrier-route combinations.

[8] I do not include panel fixed effects (e.g. carrier-route fixed effects) in Equation (1) since Greene (2004) explains that the incidental parameters problem arises when including time-invariant fixed effects in a Tobit model, leading to a downward bias in the disturbance variance parameter and unreliable estimates of marginal effects.

[9] Regional airlines do not sell tickets independently from legacy carriers and rely exclusively on legacy carriers for passenger traffic. In fact, official websites for regional airlines will merely identify the routes that it services for legacy carriers and sometimes include links to the legacy carrier's official website for ticketing purposes.

It is important to note that factors that influence *REGshare*, such as competition, can also affect *lnPrice* and are included in both stages of the regression specification. Based on conversations with industry contacts, the legacy carriers' outsourcing decision is made well in advance of the current time period. As such, the control variables in the first-stage (Equation (1)) are lagged by four quarters to account for capacity decisions that are made a year beforehand. Moreover, industry contacts claim that price is not a factor for a legacy carrier when the airline determines whether to operate a route itself or to use an independent regional airline partner, which mitigates concerns that *lnPrice* should be included as a control variable in the first-stage.

In order to assuage any endogeneity concerns with regard to competition and airfares, I follow the empirical strategy in Kwoka, Hearle, and Alepin (2016) by including three different measures of competition in the regressions: 1) the route-level Herfindahl-Hirschman Index ($HHI$); 2) the route-level market share for LCCs (*LCCshare*); and 3) the number of legacy carriers ($nLEG$) and LCCs ($nLCC$) that serve a route. Neither Kwoka, Hearle, and Alepin (2016) nor Brueckner, Lee, and Singer (2013) implement instruments for competition, arguing that potential endogeneity would lead to upward bias that would work against the typical relationship between competition and airfares. Instead, qualitatively similar regression results that suggest a negative correlation between airfares and different measures of competition alleviate the concern that any possible bias discredit the empirical findings.

The regression specification includes other control variables ($X$) that are commonly used in the existing literature. First, market density is proxied by the number of passengers at the origin airport (*OriginPax*) and destination airport (*DestinationPax*). Second, the geometric means of the population (*Pop*) and per capita income (*Income*) at the endpoint airports' MSAs represent important demand factors for a particular route. Finally, *Bankrupt* is an indicator variable that identifies if the legacy carrier is under bankruptcy protection. Summary statistics for the 185,400 observations on 2,500 routes from 1998:Q1 to 2015:Q4 are reported in Table 2.

Table 2: Summary Statistics

| Variable | Mean | S.D. | Min | Max |
|---|---|---|---|---|
| *REGshare* | 0.222 | 0.372 | 0 | 1 |
| *Price* | 212.02 | 71.30 | 53.02 | 756.80 |
| *P*10 | 111.82 | 38.11 | 50.00 | 640.50 |
| *P*90 | 357.08 | 145.18 | 54.51 | 986.04 |
| *OriginPax* | 842,580.4 | 671,992.3 | 220 | 2,532,980 |
| *DestPax* | 837,245.8 | 668,903.8 | 130 | 2,534,100 |
| *Pop* | 3,408,776.0 | 2,353,289.0 | 293,386.5 | 13,883,869.0 |
| *Income* | 40,387.62 | 7,337.56 | 19,806.86 | 80,751.14 |
| *Bankrupt* | 0.111 | 0.315 | 0 | 1 |
| *HHI* | 0.764 | 0.246 | 0.213 | 1 |
| *LCCshare* | 0.082 | 0.201 | 0 | 1 |
| *nLEG* | 1.513 | 0.708 | 1 | 5 |
| *nLCC* | 0.227 | 0.478 | 0 | 3 |
| Number of routes | | 2,500 | | |
| Number of obs. | | 185,400 | | |

Table 3 provides the main results of this paper: Observations for all six legacy carriers are pooled. The marginal effects based on the Tobit regression estimates are reported on the left hand side of the table, whereas the fixed effects regression coefficients are presented on the right hand side of the table. The number of observations used in the regression (161,728) is less than the total number of observations in the data set (185,400) due to the four-quarter-lag structure in Equation (1).

The choice of control variables is guided by the scope clauses in labor contracts, which place limits on the extent of *REGshare* as discussed in Section 2. As such, legacy carriers must strategically decide which routes ought to be operated by an independent regional airline as opposed to its own fleet. The results from the first-stage Tobit regression suggest that legacy carriers are more likely to use regional airlines on thin routes (*lnOriginPax* and *lnDestPax*) in smaller markets (*lnPop*) with higher levels of per capita income (*lnIncome*). In essence, regional airlines are more likely to be used to transport passengers between a hub airport and a small spoke airport. This allows legacy carriers to focus their fleet on busier routes between larger airports with stronger

demand that can sustainably fill the bigger planes in the legacy carrier's fleet.

Table 3: Determinants of Outsourcing and Its Effect on Average Airfares (Pooled Sample)

| First-Stage Marginal Effects (Dependent variable: *REGshare*) | | | | Second-Stage Regression Coefficients (Dependent variable: *lnPrice*) | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | | (1) | (2) | (3) |
| $lnOriginPax_{t-4}$ | $-0.014^{***}$ | $-0.012^{***}$ | $-0.014^{***}$ | $lnOriginPax_t$ | $-0.111^{***}$ | $-0.105^{***}$ | $-0.102^{***}$ |
| | (0.002) | (0.001) | (0.001) | | (0.008) | (0.008) | (0.008) |
| $lnDestPax_{t-4}$ | $-0.014^{***}$ | $-0.013^{***}$ | $-0.014^{***}$ | $lnDestPax_t$ | $-0.112^{***}$ | $-0.107^{***}$ | $-0.104^{***}$ |
| | (0.002) | (0.001) | (0.001) | | (0.008) | (0.008) | (0.008) |
| $lnPop_{t-4}$ | $-0.026^{***}$ | $-0.023^{***}$ | $-0.028^{***}$ | $lnPop_t$ | $0.192^{***}$ | $0.240^{***}$ | $0.209^{***}$ |
| | (0.003) | (0.003) | (0.003) | | (0.071) | (0.071) | (0.069) |
| $lnIncome_{t-4}$ | $0.204^{***}$ | $0.201^{***}$ | $0.203^{***}$ | $lnIncome_t$ | $0.695^{***}$ | $0.621^{***}$ | $0.511^{***}$ |
| | (0.015) | (0.015) | (0.015) | | (0.066) | (0.065) | (0.066) |
| $Bankrupt_{t-4}$ | 0.000 | 0.001 | 0.000 | $Bankrupt_t$ | $0.014^{***}$ | $0.012^{***}$ | $0.008^{**}$ |
| | (0.002) | (0.002) | (0.002) | | (0.004) | (0.004) | (0.004) |
| $HHI_{t-4}$ | $-0.040^{***}$ | | | $HHI_t$ | $0.225^{***}$ | | |
| | (0.005) | | | | (0.014) | | |
| $LCCshare_{t-4}$ | | $0.027^{***}$ | | $LCCshare_t$ | | $-0.316^{***}$ | |
| | | (0.006) | | | | (0.020) | |
| $nLEG_{t-4}$ | | | $0.014^{***}$ | $nLEG_t$ | | | $-0.003$ |
| | | | (0.002) | | | | (0.003) |
| $nLCC_{t-4}$ | | | $0.008^{***}$ | $nLCC_t$ | | | $-0.131^{***}$ |
| | | | (0.002) | | | | (0.007) |
| | | | | $\widehat{REGshare}_t$ | $-0.139^{***}$ | $-0.125^{***}$ | $-0.097^{***}$ |
| | | | | | (0.014) | (0.018) | (0.011) |
| Year-Quarter F.E. | Y | Y | Y | Year-Quarter F.E. | Y | Y | Y |
| Carrier-Route F.E. | N | N | N | Carrier-Route F.E. | Y | Y | Y |
| N | 161,728 | 161,728 | 161,728 | N | 161,728 | 161,728 | 161,728 |

Note: This table reports the marginal effects for Equation 1 and the regression results for Equation 2. Year-quarter fixed effects in both Equations 1 and 2 and carrier-route fixed effects in Equation 2 are suppressed. Standard errors, in parentheses, are clustered by carrier-route to account for correlation between carrier-route combinations over time. *, **, and *** indicate significance at the 10% level, 5% level, and 1% level, respectively.

The results in Table 3 also suggest that stronger route competition is positively correlated with *REGshare*. Since larger values of HHI correspond to weaker competition, an increase in *HHI* is associated with a negative and statistically significant effect on the usage of regional airlines. The sign for *HHI* should be opposite the signs for the alternative measures for competition. Indeed, the marginal effect for *LCCshare* is 0.027, which suggests that a 1% increase in the market share of a LCC on a route increases *REGshare* by 2.7%. Similarly, the marginal effect for *nLEG* and *nLCC* are both positive and statistically significant. Recall that an increase in *REGshare* implies an increase in outsourcing by a legacy carrier. Therefore, legacy carriers are more likely to allocate

independent regional airlines on routes where the legacy carrier experiences stronger competition, particularly from LCCs.

The second-stage results in Table 3 analyzes the effect of outsourcing on the legacy carriers' pricing strategy. Consistent with the findings in the existing literature, an increase in competition is associated with lower average airfares: a positive and significant estimated coefficient for *HHI* (0.225) and a negative and significant estimated coefficient for both *LCCshare* (-0.316) and *nLCC* (-0.131). Although the estimated coefficient for *nLEG* is negative (-0.003), it is statistically insignificant even at the 10% level. More important, the estimated coefficient for $\widehat{REGshare}$ is negative and statistically significant regardless of the measure for route competition. This negative relationship between airfares and the extent of outsourcing is being driven by the lower operating costs for regional airlines compared to legacy carriers. Thus, one of the key findings of this paper is that legacy carriers tend to offer lower prices on routes that are operated by a higher proportion of independent regional airlines.

Forbes and Lederman (2009) find that the legacy carriers' vertical integration decision is motivated by service quality concerns, whereas Forbes and Lederman (2010) find that vertical integration improves airline performance, as measured by flight delays and cancellations. The results in Table 3 complement their findings by suggesting an alternative motivation behind this outsourcing decision: Legacy carriers are more inclined to use independent regional airlines on more competitive routes, which allows them to charge a lower price.

I estimate the regression specification separately for each legacy carrier and report the regression results in Table 4. These regression results were used to construct a Chow-like F-test for both the first-stage regression and the second-stage regression. With an $F$ statistic of 9.26 (p-value = 0.000), I reject the null hypothesis that the estimated parameters are the same between all individual airlines.[10] Consistent with the pooled results, the marginal effects of competition on *REGshare*

[10]The estimated coefficient for *Bankrupt* is blank for Continental Airlines since it never went under bankruptcy protection during the sample time period.

again suggest that legacy carriers are generally more inclined to use its regional airline partners on more competitive routes; and the regression estimates for the effect of $\widehat{REGshare}$ on price again generally suggest that each legacy carrier reduces its average price for routes with a higher share of regional airlines.

In essence, although the Chow-like F-test indicates that the individual legacy carriers are distinctive, their behaviors are qualitatively similar. Consequently, I present the regression results that pool the six legacy carriers throughout the remainder of this paper.

Table 4: Determinants of Outsourcing and Its Effect on Average Airfares (Separate Regressions)

| First-Stage Marginal Effects (Dependent variable: *REGshare*) | | | | | | | Second-Stage Regression Coefficients (Dependent variable: *lnPrice*) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Legacy Carrier | AA | CO | DL | NW | UA | US | | AA | CO | DL | NW | UA | US |
| $lnOriginPax_{t-4}$ | 0.000 | −0.007 | 0.008*** | −0.045*** | −0.053*** | −0.037*** | $lnOriginPax_t$ | −0.061*** | −0.119*** | −0.060*** | −0.077*** | −0.138*** | −0.117*** |
| | (0.001) | (0.004) | (0.003) | (0.005) | (0.004) | (0.004) | | (0.014) | (0.028) | (0.013) | (0.028) | (0.019) | (0.023) |
| $lnDestPax_{t-4}$ | 0.000 | −0.006 | 0.008*** | −0.046*** | −0.053*** | −0.037*** | $lnDestPax_t$ | −0.068*** | −0.124*** | −0.061*** | −0.078*** | −0.141*** | −0.115*** |
| | (0.001) | (0.004) | (0.003) | (0.005) | (0.004) | (0.004) | | (0.014) | (0.027) | (0.013) | (0.028) | (0.020) | (0.023) |
| $lnPop_{t-4}$ | −0.021*** | −0.042*** | −0.074*** | 0.027** | 0.010 | 0.020** | $lnPop_t$ | 0.020 | 0.960*** | 0.710*** | −0.029 | −0.025 | 0.257 |
| | (0.004) | (0.009) | (0.007) | (0.011) | (0.007) | (0.009) | | (0.136) | (0.164) | (0.141) | (0.218) | (0.169) | (0.176) |
| $lnIncome_{t-4}$ | 0.064*** | 0.371*** | 0.319*** | 0.283*** | 0.341*** | 0.303*** | $lnIncome_t$ | 0.475*** | 0.268 | 1.202*** | 0.507** | 1.261*** | 0.318** |
| | (0.008) | (0.028) | (0.015) | (0.027) | (0.023) | (0.023) | | (0.136) | (0.203) | (0.143) | (0.249) | (0.177) | (0.149) |
| $Bankrupt_{t-4}$ | 0.000 | | 0.001 | −0.062*** | 0.020*** | 0.029*** | $Bankrupt_t$ | −0.050 | | −0.076 | −0.093 | −0.242*** | −0.050 |
| | (0.002) | | (0.003) | (0.004) | (0.004) | (0.003) | | (0.071) | | (0.054) | (0.080) | (0.054) | (0.051) |
| $HHI_{t-4}$ | −0.020*** | −0.017 | −0.034*** | −0.093*** | −0.023* | −0.031** | $HHI_t$ | 0.070*** | 0.042 | 0.413*** | 0.271*** | 0.345*** | 0.354*** |
| | (0.005) | (0.018) | (0.012) | (0.020) | (0.012) | (0.015) | | (0.023) | (0.047) | (0.028) | (0.053) | (0.027) | (0.043) |
| | | | | | | | $\widehat{REGshare}_t$ | 0.007 | 0.207*** | −0.173*** | −0.081** | −0.164*** | −0.141*** |
| | | | | | | | | (0.011) | (0.062) | (0.043) | (0.041) | (0.026) | (0.036) |
| Year-Quarter F.E. | Y | Y | Y | Y | Y | Y | Year-Quarter F.E. | Y | Y | Y | Y | Y | Y |
| Carrier-Route F.E. | N | N | N | N | N | N | Carrier-Route F.E. | Y | Y | Y | Y | Y | Y |
| N | 34,347 | 11,235 | 42,104 | 14,546 | 32,378 | 27,218 | N | 34,347 | 11,235 | 42,104 | 14,546 | 32,378 | 27,218 |

Note: This table reports the marginal effects for Equation 1 and the regression results for Equation 2. Year-quarter fixed effects in both Equations 1 and 2 and carrier-route fixed effects in Equation 2 are suppressed. Standard errors, in parentheses, are clustered by carrier-route to account for correlation between carrier-route combinations over time. *, **, and *** indicates significance at the 10% level, 5% level, and 1% level, respectively.

Industrial organization economists have been interested in Southwest Airlines as a case study on the effect of LCCs in the airline industry. Both Morrison (2001) and Vowles (2001) analyze the "Southwest Effect," in which entry by Southwest Airlines leads not only to a decrease in the incumbents' airfares but also to an increase in the number of passengers who fly on that route. More recent research has focused on comparing the effect of Southwest Airlines with other LCCs. Kwoka, Hearle, and Alepin (2016) find that the presence of a LCC on a route puts downward pressure on airfares with Southwest having the largest single effect on pricing. Moreover, Brueckner, Lee, and Singer (2013) show that adjacent competition with LCCs significantly reduces airfares

with Southwest again having a particularly strong effect. Consequently, it could be the case that the main results from Table 3 are largely influenced by Southwest Airlines.

In order to test whether legacy carriers respond to competition from Southwest Airlines and other LCCs in a similar fashion, I replace the route-level market share for LCCs (*LCCshare*) in both Equations (1) and (2) with the route-level market share for Southwest Airlines (*WNshare*) and the route-level market share for other LCCs (*OtherLCCshare*), as well as replacing the number of LCCs that serve a route (*nLCC*) with an indicator variable for the presence of Southwest Airlines on a route (*WN*) and the number of other LCCs on the route (*nOtherLCC*).[11]

These robustness checks provide an alternative measure of competition that originates from a particular airline. Since the purpose here is to isolate the effect of Southwest Airlines compared to other LCCs (firm-level competition), I do not include the *HHI* variable in this analysis since it measures competition at the route-level and cannot be meaningfully disaggregated to the firm-level. Table 5 presents the regression results.

Although the marginal effect for *OtherLCCshare* (-0.026) in the first-stage is negative and statistically significant in Column (1) of Table 5, the marginal effect for *WNshare* (0.070) is positive and statistically significant. This suggests the legacy carriers increase their usage of an independent regional airline partner on routes that are served by Southwest Airlines, but not when competing against other LCCs. Moreover, the second-stage regression results in Column (1) of Table 5 are qualitatively similar with those in Column (2) of Table 3, which implies that legacy carriers' average airfares are lower not only for routes where LCCs have a larger market share but also when they use an independent regional airline partner.

The results in Column (2) of Table 5 suggest that Southwest Airlines exhibits a particularly strong effect on legacy carriers' outsourcing decision and pricing strategy. Similar to the results in Column (1), the marginal effect for the presence of Southwest Airlines on a route (*WN*) in the first-stage regression is positive and statistically significant, whereas the marginal effect for the

[11] WN is the International Air Transport Association code for Southwest Airlines.

number of other LCCs (*nOtherLCC*) is negative and statistically significant. The second-stage results show that competition with Southwest Airlines and other LCCs reduces the legacy carriers' average airfares. Finally, legacy carriers' airfares are lower on routes in which the usage of their affiliated regional airlines is more prominent.

Table 5: Determinants of Outsourcing and Its Effect on Airfares (Southwest vs. Other LCC)

| First-Stage Marginal Effects (Dependent variable: *REGshare*) | | | Second-Stage Regression Coefficients (Dependent variable: *lnPrice*) | | |
|---|---|---|---|---|---|
| | (1) | (2) | | (1) | (2) |
| $lnOriginPax_{t-4}$ | $-0.013^{***}$ | $-0.014^{***}$ | $lnOriginPax_t$ | $-0.094^{***}$ | $-0.094^{***}$ |
| | (0.001) | (0.001) | | (0.008) | (0.008) |
| $lnDestPax_{t-4}$ | $-0.013^{***}$ | $-0.015^{***}$ | $lnDestPax_t$ | $-0.095^{***}$ | $-0.094^{***}$ |
| | (0.001) | (0.001) | | (0.008) | (0.008) |
| $lnPop_{t-4}$ | $-0.022^{***}$ | $-0.027^{***}$ | $lnPop_t$ | $0.274^{***}$ | $0.246^{***}$ |
| | (0.003) | (0.003) | | (0.071) | (0.069) |
| $lnIncome_{t-4}$ | $0.214^{***}$ | $0.217^{***}$ | $lnIncome_t$ | $0.403^{***}$ | $0.381^{***}$ |
| | (0.015) | (0.015) | | (0.067) | (0.069) |
| $Bankrupt_{t-4}$ | $0.003^{*}$ | 0.002 | $Bankrupt_t$ | $0.011^{***}$ | $0.007^{*}$ |
| | (0.002) | (0.002) | | (0.004) | (0.004) |
| $WNshare_{t-4}$ | $0.070^{***}$ | | $WNshare_t$ | $-0.332^{***}$ | |
| | (0.008) | | | (0.029) | |
| $OtherLCCshare_{t-4}$ | $-0.026^{***}$ | | $OtherLCCshare_t$ | $-0.354^{***}$ | |
| | (0.008) | | | (0.022) | |
| $nLEG_{t-4}$ | | $0.014^{***}$ | $nLEG_t$ | | $-0.006^{**}$ |
| | | (0.002) | | | (0.003) |
| $WN_{t-4}$ | | $0.036^{***}$ | $WN_t$ | | $-0.152^{***}$ |
| | | (0.004) | | | (0.011) |
| $nOtherLCC_{t-4}$ | | $-0.016^{***}$ | $nOtherLCC_t$ | | $-0.154^{***}$ |
| | | (0.003) | | | (0.008) |
| | | | $\widehat{REGshare}_t$ | $-0.028^{**}$ | $-0.035^{***}$ |
| | | | | (0.014) | (0.008) |
| Year-Quarter F.E. | Y | Y | Year-Quarter F.E. | Y | Y |
| Carrier-Route F.E. | N | N | Carrier-Route F.E. | Y | Y |
| N | 161,728 | 161,728 | N | 161,728 | 161,728 |

Note: This table reports the marginal effects for Equation 1 and the regression results for Equation 2. Year-quarter fixed effects in both Equations 1 and 2 and carrier-route fixed effects in Equation 2 are suppressed. Standard errors, in parentheses, are clustered by carrier-route to account for correlation between carrier-route combinations over time. *, **, and *** indicates significance at the 10% level, 5% level, and 1% level, respectively.

Gerardi and Shapiro (2009) find that increased competition puts stronger downward pressure on 90th percentile airfares than on 10th percentile airfares. I study the effect of *REGshare* on different portions of the price distribution by replacing *lnPrice* in Equation (2) with logged 10th percentile airfare (*lnP*10) and logged 90th percentile airfare (*lnP*90). Tables 6 and 7 present the regression

results using 10th percentile airfares and 90th percentile airfares as the dependent variable in the second-stage, respectively. Unsurprisingly, the first-stage regression results in Tables 3, 6, and 7 are extremely similar, regardless of the dependent variable that is used in the second-stage.

Table 6: Determinants of Outsourcing and Its Effect on 10th Percentile Airfares

| First-Stage Marginal Effects (Dependent variable: *REGshare*) | | | | Second-Stage Regression Coefficients (Dependent variable: *lnP10*) | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | | (1) | (2) | (3) |
| $lnOriginPax_{t-4}$ | $-0.014^{***}$ | $-0.012^{***}$ | $-0.014^{***}$ | $lnOriginPax_t$ | $-0.076^{***}$ | $-0.070^{***}$ | $-0.067^{***}$ |
| | (0.001) | (0.001) | (0.001) | | (0.007) | (0.007) | (0.007) |
| $lnDestPax_{t-4}$ | $-0.014^{***}$ | $-0.013^{***}$ | $-0.014^{***}$ | $lnDestPax_t$ | $-0.076^{***}$ | $-0.069^{***}$ | $-0.067^{***}$ |
| | (0.001) | (0.001) | (0.001) | | (0.007) | (0.007) | (0.007) |
| $lnPop_{t-4}$ | $-0.026^{***}$ | $-0.023^{***}$ | $-0.028^{***}$ | $lnPop_t$ | $-0.211^{***}$ | $-0.169^{**}$ | $-0.186^{***}$ |
| | (0.003) | (0.003) | (0.003) | | (0.068) | (0.068) | (0.067) |
| $lnIncome_{t-4}$ | $0.203^{***}$ | $0.201^{***}$ | $0.203^{***}$ | $lnIncome_t$ | $0.343^{***}$ | $0.301^{***}$ | $0.163^{***}$ |
| | (0.015) | (0.015) | (0.015) | | (0.059) | (0.060) | (0.057) |
| $Bankrupt_{t-4}$ | 0.000 | 0.001 | 0.000 | $Bankrupt_t$ | $0.014^{***}$ | $0.012^{***}$ | $0.008^{**}$ |
| | (0.002) | (0.002) | (0.002) | | (0.003) | (0.003) | (0.003) |
| $HHI_{t-4}$ | $-0.039^{***}$ | | | $HHI_t$ | $0.205^{***}$ | | |
| | (0.005) | | | | (0.011) | | |
| $LCCshare_{t-4}$ | | $0.027^{***}$ | | $LCCshare_t$ | | $-0.330^{***}$ | |
| | | (0.006) | | | | (0.015) | |
| $nLEG_{t-4}$ | | | $0.014^{***}$ | $nLEG_t$ | | | 0.004 |
| | | | (0.002) | | | | (0.002) |
| $nLCC_{t-4}$ | | | $0.008^{***}$ | $nLCC_t$ | | | $-0.125^{***}$ |
| | | | (0.002) | | | | (0.005) |
| | | | | $\widehat{REGshare}_t$ | $-0.119^{***}$ | $-0.117^{***}$ | $-0.074^{***}$ |
| | | | | | (0.012) | (0.016) | (0.009) |
| Year-Quarter F.E. | Y | Y | Y | Year-Quarter F.E. | Y | Y | Y |
| Carrier-Route F.E. | N | N | N | Carrier-Route F.E. | Y | Y | Y |
| N | 161,728 | 161,728 | 161,728 | N | 161,728 | 161,728 | 161,728 |

Note: This table reports the marginal effects for Equation 1 and the regression results for Equation 2, replacing logged average airfares with logged 10th percentile airfares as the dependent variable. Year-quarter fixed effects in both Equations 1 and 2 and carrier-route fixed effects in Equation 2 are suppressed. Standard errors, in parentheses, are clustered by carrier-route to account for correlation between carrier-route combinations over time. *, **, and *** indicates significance at the 10% level, 5% level, and 1% level, respectively.

The results in Tables 6 and 7 show that the impact of *REGshare* on pricing is strongest for 90th percentile airfares and weakest for 10th percentile airfares. For example, the estimated coefficient for $\widehat{REGshare}$ in Column (1) for the second-stage results in Table 3 is -0.139, which is in between the coefficient in Column (1) in Table 6 (-0.119) and in Table 7 (-0.157). A similar pattern exists for *REGshare* when using either *LCCshare* (Column (2)) or the combination of *nLEG* and *nLCC* (Column (3)) as the competition variable. This suggests that the effect of a larger share of regional

airlines that operate a route on behalf of a legacy carrier is stronger for the most expensive fares as compared to the cheapest fares.

Table 7: Determinants of Outsourcing and Its Effect on 90th Percentile Airfares

| First-Stage Marginal Effects (Dependent variable: *REGshare*) | | | | Second-Stage Regression Coefficients (Dependent variable: *lnP*90) | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | | (1) | (2) | (3) |
| $lnOriginPax_{t-4}$ | $-0.014^{***}$ | $-0.012^{***}$ | $-0.014^{***}$ | $lnOriginPax_t$ | $-0.135^{***}$ | $-0.128^{***}$ | $-0.125^{***}$ |
| | (0.001) | (0.001) | (0.001) | | (0.011) | (0.010) | (0.010) |
| $lnDestPax_{t-4}$ | $-0.014^{***}$ | $-0.013^{***}$ | $-0.014^{***}$ | $lnDestPax_t$ | $-0.137^{***}$ | $-0.130^{***}$ | $-0.128^{***}$ |
| | (0.001) | (0.001) | (0.001) | | (0.011) | (0.010) | (0.010) |
| $lnPop_{t-4}$ | $-0.026^{***}$ | $-0.023^{***}$ | $-0.028^{***}$ | $lnPop_t$ | $0.322^{***}$ | $0.375^{***}$ | $0.341^{***}$ |
| | (0.003) | (0.003) | (0.003) | | (0.095) | (0.095) | (0.093) |
| $lnIncome_{t-4}$ | $0.204^{***}$ | $0.201^{***}$ | $0.203^{***}$ | $lnIncome_t$ | $0.843^{***}$ | $0.767^{***}$ | $0.649^{***}$ |
| | (0.015) | (0.015) | (0.015) | | (0.096) | (0.095) | (0.094) |
| $Bankrupt_{t-4}$ | 0.000 | 0.001 | 0.000 | $Bankrupt_t$ | $0.015^{***}$ | $0.013^{**}$ | $0.008^{*}$ |
| | (0.002) | (0.002) | (0.002) | | (0.005) | (0.005) | (0.005) |
| $HHI_{t-4}$ | $-0.040^{***}$ | | | $HHI_t$ | $0.242^{***}$ | | |
| | (0.005) | | | | (0.018) | | |
| $LCCshare_{t-4}$ | | $0.027^{***}$ | | $LCCshare_t$ | | $-0.353^{***}$ | |
| | | (0.006) | | | | (0.025) | |
| $nLEG_{t-4}$ | | | $0.014^{***}$ | $nLEG_t$ | | | 0.001 |
| | | | (0.002) | | | | (0.004) |
| $nLCC_{t-4}$ | | | $0.008^{***}$ | $nLCC_t$ | | | $-0.144^{***}$ |
| | | | (0.002) | | | | (0.008) |
| | | | | $\widehat{REGshare}_t$ | $-0.157^{***}$ | $-0.144^{***}$ | $-0.114^{***}$ |
| | | | | | (0.019) | (0.023) | (0.014) |
| Year-Quarter F.E. | Y | Y | Y | Year-Quarter F.E. | Y | Y | Y |
| Carrier-Route F.E. | N | N | N | Carrier-Route F.E. | Y | Y | Y |
| N | 161,728 | 161,728 | 161,728 | N | 161,728 | 161,728 | 161,728 |

Note: This table reports the marginal effects for Equation 1 and the regression results for Equation 2, replacing logged average airfares with logged 90th percentile airfares as the dependent variable. Year-quarter fixed effects in both Equations 1 and 2 and carrier-route fixed effects in Equation 2 are suppressed. Standard errors, in parentheses, are clustered by carrier-route to account for correlation between carrier-route combinations over time. *, **, and *** indicates significance at the 10% level, 5% level, and 1% level, respectively.

# 4 Conclusion

This paper investigates the determinants and effects of legacy carriers' decision to outsource the operation of a route to their independent regional airline partners. I find that legacy carriers increase their usage of an independent regional airline on routes that experience stronger competition, particularly from LCCs. Moreover, the results suggest that this partnership is associated with

lower airfares along the legacy carriers' price distribution. Therefore, I conclude that the growth of regional airlines in the U.S. airline industry encourages a pro-competitive response from legacy carriers.

Although regional airlines provide a more cost-efficient alternative to operating a route themselves, legacy carriers are unable to use regional airlines on all routes. First, regional airlines have made the strategic decision to own a fleet of smaller aircraft that can carry only between 50-100 passengers and are limited by a maximum range of 1,500 miles. As such, legacy carriers would not want to use regional airlines if the distance is too far or if the demand for a particular route is too high. In these cases, it would be more profitable for a legacy carrier to operate the route with its own fleet and aircrew. Moreover, scope clauses in labor agreements with legacy carriers limits the number of routes that can be outsourced to regional airlines although these restrictions have been relaxed in recent labor negotiations. Despite these limitations, regional airlines serve as a means for legacy carriers to compete more effectively with competitors on certain routes.

Industrial organization economists have long been interested in pricing phenomena, particularly in the U.S. airline industry. Previous papers have found evidence that airlines charge higher prices at their hub airport[12] and that competition affects the ability for airlines to price discriminate.[13] This paper analyzes a different mechanism for price competition between airlines by investigating how outsourcing in the airline industry allows legacy carriers to set a lower price in order to better compete with rival airlines.

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[12] See Borenstein (1989), Lee and Luengo-Prado (2005), and Lederman (2008).

[13] See Borenstein and Rose (1994), Stavins (2001), and Gerardi and Shapiro (2009).

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