The Impact of Bankruptcy on Airline Service Levels

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The current financial crisis in the commercial airline industry has engendered an active debate over appropriate governmental policies. Proponents of government support, instrumental in legislating a $5 billion cash transfer and $10 billion loan guarantee fund for U.S. carriers following September 11, 2001, point to the critical role that airlines play in the U.S. economy and the devastating effects airline failures could have on air service.[1] Opponents argue that most airlines continue to operate through bankruptcy resolution and that even a complete shutdown of a major carrier, which rarely occurs, would stimulate expansion by other airlines to replace its abandoned flights.

This debate highlights the need to understand the *causal* effect of airline financial distress on airline operations, distinct from correlations that may exist as a result of adverse demand or cost shocks that lead to both service declines and financial distress. We focus on airline Chapter 11 bankruptcy filings, an extreme measure of financial distress. We use data from 1984 through 2001 to evaluate the impact of major bankruptcies on the level of flights and destinations served at U.S. airports.

Our results suggest that bankruptcy induces modest declines in service levels, particularly at midsize airports. This raises the question of whether such declines are socially inefficient. Restrictions imposed by the bankruptcy court judge or the creditors of an airline operating under Chapter 11 may affect total industry output or capacity offered if other carriers cannot rapidly replace the production of the constrained firm (i.e., if firms are not homogeneous and entry is not costless). With heterogeneous firms, one firm may be uniquely positioned to supply a flight, and its decision not to do so may lead to a reduction in total service. This is particularly likely in network industries, such as airlines, where there are strong production complementarities across routes.

It is also possible, however, that pre-bankruptcy service levels were inefficiently high. The bankrupt carrier may have overprovided service, perhaps in an attempt to build market share, or flight-frequency competition among carriers may have led to excessive flights. In these cases, the flight reduction associated with bankruptcy may cause a movement toward the socially optimal level of service. Our work takes a first step toward resolving this issue, by determining the magnitude of bankruptcy effects on aggregate air service. The results suggest the need for further research to assess its possible welfare implications.

I. Empirical Analysis of Airport Service Levels

We estimate the effect of airline Chapter 11 bankruptcy filings on the change in aggregate domestic service at the 195 largest U.S. airports, using quarterly data from 1984 to 2001.[2] Airport service levels change frequently and substantially, as airlines re-optimize their networks

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[1] See, for example, Juliet Eilperin (2002), who quotes U.S. Representative James Moran of Virginia on USAir's loan guarantee application: "The worst-case scenario is they go bankrupt, 40,000 people lose their jobs and more than 200 cities lose their air service."

[2] These are the top 200 U.S. airports minus five that are outside the 50 states (e.g., Guam). We focus only on domestic service, because the number of international flights and their operators remain heavily regulated by bilateral treaties.

in response to altered demand, cost, and supply conditions. In our sample, the median absolute value of quarterly changes in airports' total nonstop domestic flights is greater than 4 percent. Fortunately, the rich structure of airline markets and airline data provides substantial power in identifying the effect of a carrier's bankruptcy on aggregate service. We first describe our measures of service at an airport, then the variables that capture the effect of bankruptcy, and finally, controls for demand and cost variations that might induce changes otherwise attributed to airline financial distress.

A. *Service*

We construct two measures of aggregate airline service: total nonstop domestic flights to and from the airport, and the number of domestic destinations that can be reached by nonstop flights from the airport.[3] This seems to us most consistent with the current policy focus on the impact of a major carrier's bankruptcy on available air-travel options.[4] The empirical models use changes in the natural logs of these service measures from the previous quarter as the dependent variables, d ln(FLIGHTS) and d ln(DESTINATIONS).

B. *Bankruptcy*

Measuring the exposure of an airport-quarter to bankruptcy effects requires two components: the date a carrier files for Chapter 11 protection, and the share of operations at that airport accounted for by the filing carrier. We identified 17 significant airline Chapter 11 bankruptcy filings over our sample period. Eight of these involved large domestic carriers, defined as carriers offering more than 25,000 flights per quarter prior to bankruptcy: Eastern (1989), Braniff (second filing, 1989), Continental (second filing, 1990), America West (1991), Midway (1991), and three TWA filings (1992, 1995, 2001). While four of these filings resulted in carriers emerging from Chapter 11 protection, only Continental and America West continue as major carriers today. We report results based on these eight bankruptcies, though they are qualitatively similar to those obtained for the entire sample of 17 bankruptcy filings, and to those obtained dropping Eastern from the analysis (see Borenstein and Rose, 2003).[5]

For each bankruptcy filing i, we construct a one-quarter-long interval centered on the filing date, FILED_i. QTRFILED_{it} is equal to the fraction of quarter t that overlaps with FILED_i. Thus, for a filing that occurs mid-quarter, QTRFILED_{it} is 1 for the filing quarter and 0 for all other quarters. For filings earlier in the quarter, QTRFILED_{it} will be positive for the quarter before and the quarter of filing, with the values in these two quarters summing to 1; a similar construction applies for filings later than mid-quarter.

At each airport j, we construct $\text{BRSHARE}_{ijt} = \text{QTRFILED}_{it} \times \text{SHARE}_{ij}$, where SHARE_{ij} is the share of total nonstop flights at airport j accounted for by filing carrier i four quarters before its Chapter 11 filing. We use the four-quarter prior share to minimize the impact of any schedule changes in the quarters immediately preceeding the filing. We sum across all bankruptcy filings to obtain BRSHARE_{jt}. Leads and lags of BRSHARE_{jt} are used to capture changes in service over the quarters leading up to and following bankruptcy filings.

C. *Seasonal and Time-Period Fixed Effects*

The model includes a full set of airport-seasonal effects (ϕ_{jq}) to control for systematic changes in service levels at a given airport over the year. These pick up differences in seasonal demand patterns across airports, as well as any systematic growth or decline in an airport's service over the sample period (captured in the mean of the airport-seasonal effects for each airport). We also include a full set of time-period effects (δ_t), which control for quarterly macroeconomic fluctuations, systemwide airline cost changes, and other shocks common to all airports in a given quarter.

[3] For a complete description of the data sources and estimation, see Borenstein and Rose (2003).

[4] Bankruptcy effects on the number of seat-departures (flights multiplied by capacity of each plane) and seat-mile-departures (seat-departure times the nonstop distance of each flight) are similar to those reported for flights.

[5] Eastern's filing followed by less than a week a strike that forced the airline to greatly reduce flights.

D. *Regional Economic Conditions*

Changes in local demand conditions may lead to service changes at an airport. We control for regional economic conditions with changes in (log of) employment and income at the state level. Aggregate employment is based on total nonagricultural employment; income is aggregate personal income. To allow these variables to function as leading or lagging indicators of air-travel demand, we include in the model one- and two-period lag changes and one- and two-period lead changes, as well as contemporaneous change in log income and employment.

This yields the following first-differenced empirical specification:[6]

$$d\ \ln(S_{jt}) = \sum_{n=-2}^{2} \beta_n \times \text{BRSHARE}_{j,t+n} + \sum_{n=-2}^{2} \gamma_n \times d\ \ln(\text{EMPLOYMENT}_{j,t+n}) + \sum_{n=-2}^{2} \alpha_n \times d\ \ln(\text{INCOME}_{j,t+n}) + \delta_t + \sum_{q=1}^{4} \phi_{jq} \times I_{qt} + \varepsilon_{jt}$$

where S_{jt} is the service level measured as either nonstop flights (FLIGHTS) or number of destinations served nonstop from the airport (DESTINATIONS), I_{qt} is equal to 1 if quarter t is the qth quarter of the year and otherwise 0.

II. Results

Table 1 presents estimated bankruptcy coefficients for each of our measures of airport service levels. The unreported airport-seasonal effects are jointly significant at the 1-percent level in all regressions, as are the time-period fixed effects and regional macroeconomic variables.[7] Looking first at the flights column, the antilog of the −0.201 coefficient on BRSHARE_t implies that in the quarter a carrier files for Chapter 11 bankruptcy protection, the number of flights at the airports it serves declines by about 20 percent of the flights it had operated. Thus, if the bankrupt carrier had previously had a 20-percent share at a certain airport, its bankruptcy is estimated to reduce the total number of flights at the airport by 3.9 percent during the quarter of bankruptcy. The cumulative effect over the time period beginning two quarters prior to bankruptcy filing and ending two quarters after the filing, measured by the sum of the five BRSHARE variables, is very imprecisely estimated at −0.087. The second column of Table 1 reports results using the total number of destinations served nonstop from an airport as the dependent variable. The current quarter and cumulative five-quarter effects of bankruptcy on destinations are quite imprecisely estimated,

TABLE 1—ESTIMATION USING ALL AIRPORTS

Independent variable	Dependent variable: $d\ \ln$(FLIGHTS)	Dependent variable: $d\ \ln$(DESTINATIONS)
BRSHARE_{t+2}	−0.005	−0.168*
	(0.049)	(0.074)
BRSHARE_{t+1}	0.006	0.143†
	(0.048)	(0.086)
BRSHARE_t	−0.201*	−0.087
	(0.066)	(0.101)
BRSHARE_{t-1}	0.026	0.062
	(0.079)	(0.120)
BRSHARE_{t-2}	−0.005	−0.005
	(0.049)	(0.091)
Five-quarter aggregate BRSHARE effect	−0.087	−0.054
	(0.099)	(0.164)

Notes: Number of observations = 12,642. Regional macroeconomic variables (employment and income), airport-seasonal fixed effects (four per airport), and time-period fixed effects (one per quarter) are not reported. Robust standard errors are reported in parentheses.

† Statistically significant at the 10-percent level.

* Statistically significant at the 5-percent level.

[6] The data exhibit no serial correlation in the residuals for d ln(FLIGHTS). Reported standard errors have not been corrected for the modest (−0.25) negative serial correlation in the residuals for d ln(DESTINATIONS) and, hence, may overstate true standard errors.

[7] The effects of the regional macroeconomic variables are not estimated precisely individually, and some point estimates are negative (though not significant), but their aggregate effects are positive in all regressions.

though the point estimates are roughly of the same order of magnitude as for flights.

We next explore whether bankruptcy effects differ by airport size. Political concerns about airline bankruptcies have in some cases focused on the largest airports and metropolitan areas, while in other cases more concern has attached to service to smaller communities. Our sample exhibits substantial heterogeneity in service levels. We break out the impacts of bankruptcy by airport size, dividing our sample into three groups. The "large" airports are those averaging more than 400 flight operations per day during our 18-year sample. The 26 airports in this group include all large hubs. The 51 "medium" airports average between 100 and 400 flights per day and include smaller hubs (e.g., Memphis, Dayton, Washington–Dulles), secondary airports in large cities (e.g., Oakland, Midway, Houston–Hobby) and midsize cities (e.g., New Orleans, Indianapolis, Reno). The remaining 118 "small" airports average between 8 and 100 flights per day.

Table 2 reports results allowing bankruptcy effects to differ by airport size, while still estimating pooled time and regional macroeconomic effects. Medium and small airports experience significant declines in flights during the quarter of bankruptcy filing, estimated to be about 24 percent of the service that the bankrupt carrier had been offering. The bankrupt-quarter effect is smaller at large airports and not statistically significant. The aggregate five-quarter effect for large airports is estimated to be −0.127. The point estimate implies that service at these airports declines by about 12 percent of the number of flights that the bankrupt carrier had previously offered, but a 95-percent confidence interval is (−26 percent, +5 percent). For medium-sized airports, the estimated aggregate effect is much larger, about 46 percent of the bankrupt carrier's previous service, and is larger than for large airports (at the 12-percent significance level). At small airports, the economically and statistically significant decline in flights during the filing quarter appears to be offset by changes in subsequent quarters, leading to an estimate of virtually no change over the five-quarter window. The five-quarter bankruptcy impacts on DESTINATIONS follow a similar pattern to the FLIGHTS results. At large airports, the five-quarter estimates imply that the number of destinations served declines by about 18 percent of the bankrupt carrier's previous share of flights. For medium-sized airports, the decline is estimated to be 41 percent of the carrier's previous share of flights. For small airports, the estimate is slightly positive, but statistically indistinguishable from zero. These results suggest that the greatest impact of bankruptcy on service occurs at the medium-sized airports.[8]

TABLE 2—ESTIMATION OF BANKRUPTCY EFFECT BY AIRPORT SIZE

	Airport size		
Independent variable	Large	Medium	Small
A. *Dependent Variable* = *d* ln(FLIGHTS):			
$BRSHARE_{t+2}$	0.017	0.056	−0.016
	(0.044)	(0.106)	(0.067)
$BRSHARE_{t+1}$	−0.051	−0.138	0.042
	(0.035)	(0.114)	(0.065)
$BRSHARE_{t}$	−0.062	−0.241*	−0.240*
	(0.050)	(0.119)	(0.092)
$BRSHARE_{t-1}$	−0.088	0.043	0.069
	(0.057)	(0.132)	(0.109)
$BRSHARE_{t-2}$	0.056	−0.183	0.145*
	(0.062)	(0.219)	(0.072)
Five-quarter aggregate BRSHARE effects	−0.127	−0.463*	0.001
	(0.088)	(0.216)	(0.138)
B. *Dependent Variable* = *d* ln(DESTINATIONS):			
$BRSHARE_{t+2}$	−0.057	−0.123	−0.209*
	(0.049)	(0.121)	(0.105)
$BRSHARE_{t+1}$	−0.000	−0.092	0.228†
	(0.043)	(0.136)	(0.122)
$BRSHARE_{t}$	−0.072	−0.103	−0.080
	(0.050)	(0.160)	(0.140)
$BRSHARE_{t-1}$	0.022	0.100	0.073
	(0.052)	(0.132)	(0.170)
$BRSHARE_{t-2}$	−0.074	−0.192	0.050
	(0.053)	(0.140)	(0.127)
Five-quarter aggregate BRSHARE effect	−0.182*	−0.411†	0.063
	(0.092)	(0.213)	(0.240)

Notes: Number of observations = 12,642. Regional macroeconomic variables (employment and income), airport-seasonal fixed effects (four per airport), and time-period fixed effects (one per quarter) are not reported. Robust standard errors are reported in parentheses.

† Statistically significant at the 10-percent level.

* Statistically significant at the 5-percent level.

[8] Although the break points we use to define large, medium, and small airports are somewhat arbitrary, the pattern of results are robust to a wide range of alternative choices: small airports exhibit no significant effect over the five-quarter window, medium airports experience the great-

TABLE 3—DISTRIBUTION OF PERCENTAGE CHANGE IN FLIGHTS AT AIRPORTS WITH NO BANKRUPTCY EFFECT

	Percentage change			
Percentile	All airports	Large airports	Medium airports	Small airports
1	−36.1	−13.1	−24.5	−40.5
3	−23.5	−9.8	−13.4	−27.5
5	−17.2	−8.0	−10.1	−20.6
10	−10.5	−5.6	−6.7	−12.8
15	−7.4	−4.4	−5.2	−9.1
20	−5.6	−3.6	−4.0	−6.9
25	−4.2	−2.6	−3.2	−5.1
50	+0.1	+0.4	+0.5	+0.1
75	+4.9	+3.9	+4.4	+5.4

It is useful to put these results into context by comparing bankruptcy-induced changes to the "typical" quarterly variation in service that occurs at airports as a consequence of seasonal demand variation, macroeconomic fluctuations, and other factors. Table 3 reports the distribution of changes in service that occur in airport-quarters with no significant bankruptcy impact.[9] Consider, for example, the bankruptcy of a major carrier at an airport, one with a 30-percent share of flights. Our results suggest that this would reduce total flights by 3.7 percent at a large airport. A change of this magnitude would not be particularly unusual, occurring in nearly one in five large-airport-quarters, absent bankruptcy. The 13.0-percent change implied by our results for a medium-sized airport would be more unusual, falling in the third percentile of the no-bankruptcy distribution. For a carrier with a 10-percent share of flights at an airport, the total change in flights is estimated to be 1.3 percent at a large airport and 4.5 percent at a medium-sized airport, neither of which would likely be noticable among the normal fluctuations in service at such airports.

est bankruptcy-induced declines, and the estimated magnitude of both large- and medium-airport effects increases as we use a cut that moves more airports from the "medium" to "large" category.

[9] This excludes any airport-quarter in which a carrier in bankruptcy operated during the five-quarter window around its bankruptcy.

III. Conclusion

We find that airline bankruptcies reduce service at some airports. At large airports, the effect is weakly significant, but the magnitude is not large in comparison to the normal fluctuations in service. The estimated effect is greatest at midsize airports where bankruptcy of a carrier with a large share of flights may reduce service by amounts that would stand out from the typical quarter-to-quarter variation. At small airports, a brief decline in service appears to be quickly offset in the following quarters, with the net impact over five quarters being small and statistically insignificant.

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