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Bankruptcy and product-market competition: Evidence from the airline industry ☆

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ABSTRACT

We investigate the effects of Chapter 11 bankruptcy filings on product market competition using data from the US airline industry. We find: i) bankrupt airlines permanently downsize their national route structure, their airport-specific networks, and their route-specific flight frequency and capacity; ii) bankrupt airlines lower their route-specific prices while under bankruptcy protection, and increase them after emerging. We do not find robust evidence of significant changes by the bankrupt airline's competitors along any of the dimensions above.

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1. Introduction

In the past few years thousands of firms have filed for bankruptcy protection under Chapter 11 of the United States Bankruptcy Law.[2] Firms filing for bankruptcy protection belong to a wide range of industries, from Lehman Brothers to Chrysler and GM.[3] The unprecedented number of filings has led to a renewed interest in the economics of bankruptcy. Most of the previous work has examined the direct costs of bankruptcy proceedings, such as legal and administrative expenses, as well as their indirect costs, such as lost sales (Bebchuk, 2002; Bris et al., 2006; Franks and Torous, 1989; Hennesy and Whited, 2007; Thorburn, 2000).[4] There is also work on the effects of bankruptcy on firm survival (Hotchkiss, 1995), on equity returns (Jorion and Zhang, 2009), and on innovation (Acharya and Subramanian, 2009). Nonetheless, there is surprisingly little work on the effects of bankruptcy filings on product market competition.

This paper uses data from the US airline industry to investigate the effect of Chapter 11 filings on prices, capacity choices, and networks. These data are from one single industry for which we have data from a cross-section of local markets. This allows an examination of how bankruptcy filings affect the strategic decisions of firms, holding industry fixed. In this sense, our approach is in the same spirit as Chevalier (1995a, 1995b), who uncovers basic stylized patterns in the relationship between leverage buyouts and the pricing behavior of firms and their rivals using cross-section data from the US supermarket industry.

The airline industry provides an interesting empirical framework for several additional reasons. First, air transport is arguably the most important means of transportation in the US. Second, the airlines seeking

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[2] There have also been an outstanding number of personal bankruptcy filings. See White (2007) for more on this.

[3] Lehman Brothers filed in July 2008. Chrysler and GM filed in April and June 2009, respectively.

[4] See also the early work by White (1982). Recently, there has been extended research comparing auctions against a reorganization-based bankruptcy system such as Chapter 11. See Hotchkiss and Mooradian (2003) and Eckbo and Thorburn (2009).

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bankruptcy protection form a heterogeneous group, including low cost carriers such as ATA, and national carriers such as United and USAir. The range of variation in the identities of the bankrupt airlines ensures that our empirical analysis provides insights on other industries as well. Third, because it is one industry where carriers interact over many distinct markets and over time, we can identify the effects of bankruptcy on product market competition, independent of potentially confounding market, firm, and time effects. Finally, because there are bankrupt and non-bankrupt carriers serving the same market, we can investigate different carriers' price reactions to one carrier's bankruptcy.

We start our analysis by looking at how bankruptcy filings affect the network of the bankrupt carrier and of its rivals. We find that at the US national level, the bankrupt carrier permanently drops approximately 25% of its pre-bankruptcy routes. We also look at airport specific networks. Not surprisingly, we find similar results. The bankrupt carrier reduces its average number of markets out of an airport by 26% while under bankruptcy protection, and by 24 after its emergence from Chapter 11 relative to its pre-bankruptcy numbers. Its rivals increase the average number of markets they serve at the US national level, but this result is not very robust across specifications and we do not confirm it when we look at changes in the number of markets out of airports. Next, we investigate how bankruptcy filings affect the flight frequency and capacity decisions. We find that the bankrupt firm lowers by 21% the average frequency of flights within a route while operating under court protection, and by 32.8% once the carrier emerges from bankruptcy. We also find that bankruptcy filings have an equally significant effect on the bankrupt's average capacity (measured by seats in a route) both during and following a bankruptcy filing. We do not find robust evidence of any significant changes by the bankrupt airline's competitors along any of the dimensions above. We conclude our analysis with a study of the effects of bankruptcy filings on airline market mean prices. We find that the insolvent carrier's price drops by 3.1% while under bankruptcy protection, and *increases* by almost 5% after emerging, both of these numbers relative to pre-bankruptcy prices. Again, we do not find evidence of any significant changes by the bankrupt airline's competitors along any of the dimensions above.

This article contributes to the sparse empirical literature on product-market competition and bankruptcy. Borenstein and Rose (1995, 2003) also study the relationship between bankruptcy filings and product-market competition.[5] In looking at the effect on prices and on frequency, they find that in the quarter during which a carrier files for Chapter 11 protection, the number of flights at the airports where the bankrupt carrier operates declines by about 20% relative to the pre-bankruptcy level. Borenstein and Rose (1995) do not find any systematic evidence that either bankrupt firms or their competitors changed prices after a bankrupt firm's Chapter 11 filing. Mainly, our analysis differs from theirs along four dimensions. First, we look at multiple strategic decisions (airport and national network structure, capacity choices, prices). Thus, we can provide a unified framework to understand the effect of bankruptcy filings. Instead, Borenstein and Rose (1995, 2003) limited their analysis just to changes in prices and in number of markets out of airports. We show that the most important changes concern capacity choices in the markets that airlines continue to serve and the size of the network served by the bankrupt airline after exiting from bankruptcy. Second, we investigate the effects during and after a competitor's bankruptcy filing. The post-emergence analysis adds to our understanding of what the 'permanent' changes are in the set of services offered following a firm's bankruptcy filing. This conforms to the notion that the main purpose of bankruptcy filings should be to allow firms time to reorganize themselves and that the evaluation of the economic success of a bankruptcy filing should be made after the firm's exit from bankruptcy. Third, we show that the effects are fundamentally different for the bankrupt firms and their rivals. In contrast, Borenstein and Rose (1995, 2003) estimate the average effect across both filing and non-filing carriers, and therefore they do not identify the effect on the filing carrier separately from that on its competitors. This is important because bankruptcies do not only affect the bankrupt firm but also its competitors. It is quite emblematic that all the legacy carriers in the United States have now filed at least once for Chapter 11. Fourth, we include specifications that control for such unobserved heterogeneity using route–carrier fixed effects, since it is likely that there are heterogeneous route–carrier unobservables that might confound the results in Borenstein and Rose (1995, 2003). Including route–carrier fixed effects rather than just carrier fixed effects and route fixed effects has been shown to be of fundamental importance in empirical studies of the airline industry.[6]

This work is also related to a growing theoretical literature that examines whether a firm's capital structure impacts competition in the market for the firm's products. This literature focuses on how financial distress impacts the competitive interaction of distressed and non-distressed firms in an industry (Bolton and Scharfstein, 1990; Brander and Lewis, 1986; Dasgupta and Titman, 1998; Hendel, 1996). Several empirical papers followed providing evidence of the interaction between financial distress and product market competition (Bhagat et al., 2005; Bolton and Scharfstein, 1990; Campello, 2006; Chevalier, 1995a, 1995b; Chevalier and Scharfstein, 1995, 1996; Kovenock and Phillips, 1997; Phillips, 1995), and between bankruptcy filings and stock market performance (Ferris et al., 1997). Within this literature, the closest paper to ours is Chevalier (1995a). Our paper differs from hers along one important dimension: we have data on the individual price of the firms, while Chevalier only has data on the average price in a market. This additional information is of crucial importance in our empirical analysis since we do not find evidence of almost any reaction by the rivals of firm that files for Chapter 11 protection.

2. Bankruptcies in the airline industry

Several factors that can alter the competitive interaction between firms in an industry come into play when one of the firms reorganizes under Chapter 11.[7] First, the bankrupt firm faces cost shocks inherent to operating under court protection, such as the ability to renege and renegotiate contracts. Furthermore, the bankrupt firm faces demand shocks that can result in reduced demand for its products, as in Opler and Titman (1994). Finally, reorganization might entail changes in the firm's product quality (see Maksimovic and Titman, 1991),

[5] In addition to the differences discussed in the body of the article, our analysis differs from theirs along two other dimensions. First, it is likely that there are heterogeneous route-carrier unobservables that might confound the results in Borenstein and Rose (2003). We control for this using route-carrier fixed effects. Second, bankruptcy categorical variables might proxy for the changes in the services that the (bankrupt and non-bankrupt) firms provided even when no carrier was operating under bankruptcy protection. We include carrier specific dummies in order to avoid confounding the bankruptcy effects with the carrier-specific effects.

[6] Kristopher and Shapiro (2009) analyzed the effects of competition on price dispersion in the airline industry, using panel data from 1993:Q1 through 2006:Q3 and showed that their results contrasted with those of Borenstein and Rose (1994), who found that price dispersion increased with competition. Kristopher and Shapiro presented evidence that the different results in Borenstein and Rose (1994) and Kristopher and Shapiro (2009) were reconciled by showing that not including route fixed effects would not be enough to control from omitted-variable bias.

[7] The United States Bankruptcy Code contemplates two alternative solutions for firms in financial distress filing for court protection: Chapter 7 and Chapter 11. Chapter 7, entitled Liquidation, allows for an orderly, court-supervised procedure by which a trustee collects the assets of the firm, reduces them to cash, and makes distributions to creditors subject to the debtor's right to retain certain exempt property and to the rights of secured creditors. Chapter 11, entitled Reorganization, allows the bankrupt firm to continue operating while the firm's management restructures the firm's business. Firms that file for Chapter 11 are those deemed a viable ongoing concern which can potentially repay creditors through a court-approved reorganization plan. We focus on Chapter 11 filings and drop firms filing under Chapter 7 because we are interested in the competitive and strategic effect triggered by a firm in the market that operates under bankruptcy protection, and firms filing for Chapter 7 stop operations and liquidate their assets.

Table 1
Stylized facts. Bankruptcies in the airline industry between 1992 and 2007. Airline bankruptcies are identified from the Air and Transportation Association (ATA), and cross checked with the Bankruptcy Research Database from Professor Lynn LoPucki. The remaining information is obtained from news searches in Lexis-Nexus and Factiva.

Code	Airline name	File 11	File 7	Voluntary	Filing Nu.	Date Filed	Date Emerged	Convert 11 to 7	Convert 11 to 7	Grounded	Days
WV	Air South, Inc.	1	0	1	1	8/28/1997	0	1	9/16/1997	8/28/1997	18
AQ	Aloha Airlines, Inc.	1	0	1	1	12/30/2004	2/17/2006	0	0	0	414
HP	America West Airlines, Inc.	1	0	1	1	6/27/1991	8/25/1994	0	0	0	1138
TZ	Ata Airlines d/b/a Ata.	1	0	1	1	10/26/2004	2/28/2006	0	0	0	490
HQ	Business Express	1	0	0	1	1/22/1996	4/17/1997	0	0	0	445
CO	Continental Air Lines, Inc.	1	0	1	2	12/3/1990	4/27/1993	0	0	0	864
DL	Delta Airlines	1	0	1	1	9/14/2005	4/25/2007	0	0	0	563
W9	Eastwind Airlines, Inc.	0	1	0	1	9/30/1999	0	0	0	9/8/1999	
QD	Grand Airways, Inc.	1	0	1	2	11/28/1995	0	1	1/4/1996	1/4/1996	36
HA	Hawaiian Airlines, Inc.	1	0	1	1	9/21/1993	9/12/1994	0	0	0	351
HA	Hawaiian Airlines, Inc.	1	0	1	2	3/21/2003	6/2/2005	0	0	0	791
FLYi	Independence Air	1	0	1	1	11/7/2005	1/5/2006	0	0	0	59
KP	Kiwi International	1	0	1	1	9/30/1996	0	1	7/17/1997	10/15/1996	287
KP	Kiwi International	1	0	1	2	3/23/1999	0	1	8/27/1999	3/24/1999	154
BF	Markair, Inc.	1	0	1	1	6/8/1992	5/4/1994	0	0	0	686
BF	Markair, Inc.	1	0	1	2	4/14/1995	0	1	12/4/1995	10/25/1995	230
JI	Midway Airlines, Inc.	1	0	1	2	8/14/2001	0	1	10/30/2003	9/11/2001	796
N7	National Airlines	1	0	1	1	12/6/2000	0	1	11/6/2002	11/6/2002	690
NW	Northwest Airlines	1	0	1	1	9/14/2005	5/18/2007	0	0	0	611
PN	Pan American Airways Corp.	1	0	1	2	2/26/1998	6/28/1998	0	0	2/26/1998	122
P9	Pro Air, Inc.	1	0	1	1	9/19/2000	0	1	10/5/2001	9/19/2000	376
SY	Sun Country Airlines	0	1	0	1	1/8/2002	4/15/2002	7 to 11: 3/13/2002	4/15/2002	12/7/2001	97
FF	Tower Air, Inc.	1	0	1	1	2/29/2000	0	1	12/7/2000	5/1/2000	282
TW	Trans World Airways, Llc	1	0	1	1	1/30/1992	11/3/1993	0	0	0	633
TW	Trans World Airways, Llc	1	0	1	2	6/30/1995	8/24/1995	0	0	0	54
TW	Trans World Airways, Llc	1	0	1	3	1/10/2001	0	0	4/9/2001	0	89
UA	United Airlines	1	0	1	1	12/9/2002	2/2/2006	0	0	0	1513
US	USAir	1	0	1	1	8/11/2002	3/31/2003	0	0	0	230
US	USAir	1	0	1	2	9/12/2004	9/27/2005	0	0	0	375
NJ	Vanguard Airlines, Inc.	1	0	1	1	7/30/2002	0	1	12/19/2003	7/30/2002	499
W7	Western Pacific Airlines	1	0	1	1	10/5/1997	0	1	2/4/1998	2/4/1998	119

inventory (Hendel, 1996), and capacity. These also have the potential to disrupt the competitive interaction of firms in the industry. To capture all of these changes we use *bankruptcy categorical variables*.

2.1. Stylized facts of airline bankruptcies

Table 1 summarizes some stylized facts.[8] Consistent with Bris et al. (2006) and Schoar and Chang, 2007, this table reveals significant heterogeneity among bankruptcies. This is most evident in the range of time that the firm spends under bankruptcy (from 18 days for Air South to 1513 days for United Airlines), the way in which the firm resolves its bankruptcy (emerging or having to convert to Chapter 7 liquidation); and the specific way in which the emerging firm exits bankruptcy (on its own, or merging with another carrier). Columns 3 and 4 show that almost all airlines first file for Chapter 11 protection. Large airlines soon begin to develop a reorganization plan. Smaller carriers first attempt to keep the business alive by seeking an investor that would buy the carrier's flying certificate and any other assets the carrier might still posses. If the carrier's management is unsuccessful at finding such investor(s), the carrier converts its Chapter 11 filing into a Chapter 7 filing. For instance, in the case of MarkAir's second filing the US Bankruptcy court changed the carrier's Chapter 11 filing to Chapter 7, after the carrier spent 8 months under Chapter 11. Column 5 shows that in only two cases, Sun Country and Eastwind, the filing was a Chapter 7 Liquidation initiated by the carrier's creditors who took the firm to court.[9] Some airlines file for Chapter 11 protection multiple times (Column 6). The probability that it emerges as an independent entity declines with the number of past filings and with shorter time spans between filings (Columns 7 to 11). For example, USAir emerged from its second Chapter 11 filing after merging with America West, and TWA emerged from its third filing after being acquired by American. We expect the competitive behavior to change differently when carriers file for the first time, or for subsequent times and, indeed, this is what we find in our empirical analysis. Column 12 shows substantial heterogeneity in the time that a firm can operate under Chapter 11 protection. There is no clear relationship between the duration and the probability of emergence from bankruptcy.

2.2. The economics of airline industry bankruptcy filings

The reorganization of the firm's operating plan during bankruptcy can result in changes in the markets served, as well as in the way these markets are served. For example, after filing for bankruptcy protection on September 14, 2005, Delta Airlines implemented several major changes. One of the most important ones was its decision to abandon the Dallas/Fort Worth airport as one of its hubs. This led to fewer non-stop destinations out of Dallas, and fewer flights on the routes that were still served. During reorganization, the insolvent firm

[8] Airlines that have filed for bankruptcy in the last two decades are identified using the Air Transportation Association (ATA) website. This website provides a list of the names of air carriers that have filed for protection, the date of the bankruptcy filing, and the type of protection that the airline requested (reorganization under Chapter 11 or liquidation under Chapter 7). We cross check this data with the Bankruptcy Research Database compiled by Professor Lynn LoPucki. For each of the airlines filing for Chapter 11 between 1992 and 2007, we manually search Factiva and Lexis-Nexus for news report dating to about one year prior to and two years after the firm's filing. This allows us to include items such as whether the filing was voluntary or not, whether the airline originally filed for Chapter 11 but was forced to convert its filing to Chapter 7, whether the carrier emerged from bankruptcy or not, the date and the way in which the carrier exited bankruptcy, if the carrier was grounded and if so the date when it stopped flying, and if grounding was voluntary or a safety requirement imposed by the FAA.

[9] Lessors forced an involuntary liquidation of Sun Country Airlines. The FAA grounded Kiwi Airlines, MarkAir, and ProAir for safety concerns, training and maintenance violations. Unless the airline is already under court protection, the FAA grounding precipitates a bankruptcy filing.

might downsize operations in markets burdened with excess capacity and in the least profitable markets. Carriers can also downsize capacity within a market by adjusting the number of seats offered and the number of performed departures. The freed capacity can be reallocated to markets that are more profitable.[10]

Under bankruptcy, the insolvent carrier can implement cost-cutting strategies that are illegal outside of court protection, thus facilitating the firms return to profitability. Under Section 1110 of Chapter 11, a bankrupt carrier that has defaulted on its aircraft lease payments has a 60 day grace period to make lease payments and keep the aircraft. If after 60 days the carrier has not paid its outstanding lease, the lessor can repossess the aircraft. Rarely have lessors repossessed aircrafts.[11] Most lessors are willing to renegotiate payments with the bankrupt carrier because a lessor who repossesses a plane would have to redeploy it elsewhere, and if the industry is in distress, that might be more costly than extending payment schedules or renegotiating payment terms. Furthermore, since rescinded leases become a general unsecured claim on the carrier, the carrier has a strong bargaining position with their lessor.[12] In rare instances, lessors force a Chapter 11 filing over missed lease payments.[13] One of the largest burdens affecting most carriers is obligation to employees and retirees through defined benefit pension programs. Most legacy carriers under bankruptcy protection use their bankruptcy filings to renegotiate or renege on their defined benefit pension obligations. Doing so transfers the burden of pension obligations to taxpayers via the Federal Pension Benefit Guarantee Corporation (PBGC).[14] Cost reductions resulting from changes in defined benefit pension programs should outlast the firm's stay under bankruptcy protection. Labor union contracts heavily burden the airline industry. Renegotiations with unions and employees are a key cost-saving strategy in which airlines engage while operating under protection. The threat that the carrier can be forced into liquidation, leaving employees jobless, makes labor unions and employees more willing to renegotiate than they would otherwise be. Under Section 1113 of Chapter 11, an airline can unilaterally modify labor agreements if negotiations turn out to be unsuccessful.[15] Just the threat that the bankrupt carrier can turn to Section 1113 shifts most of the bargaining power to the airline.

A bankruptcy filing can affect consumers' willingness to pay for the services that the insolvent firm provides. Such a negative demand shock might reverse once the carrier exits bankruptcy. Reputation costs associated with a bankruptcy filing can reduce the demand for the carrier's flights. Opler and Titman (1994) show that highly leveraged firms lose substantial market share to their more conservatively financed competitors during industry downturns. Similarly, bankrupt firms (which represent the extreme case of excessive leverage) might lose significant market share to competitors. Safety consideration aside, passengers might still prefer to fly non-bankrupt carriers if they are concerned that the insolvent firm will not honor its frequent flier obligations. Passengers have voiced concerns that, even if the carrier emerges from bankruptcy, frequent flier miles might not be honored.[16] This can drive demand away from the distressed carrier to its non-distressed competitor.

3. Data Description

Our data is an original compilation from several sources. From the Air Transportation Association Web site, Lynn LoPucki's Bankruptcy Database, and Factiva and Lexis-Nexis reports, we obtain the identity of carriers filing for bankruptcy, the dates on which each carrier entered and exited court protection, and the specific way in which each carrier emerged from protection. We merge this dataset with data from The "On-Time Performance Schedule" gathered by the Bureau of Transportation Statistics (BTS); the T-100 Domestic Segment of Form 41 reported by the BTS; the Origin and Destination Surveys (DB1B), which is a ten percent sample of airline tickets sold by airlines within a quarter.

3.1. Carriers, markets, and routes

We consider nine national carriers between 1997 and 2007: American (identified by its airline code, *AA*), Continental (*CO*), Delta (*DL*), America West (*HP*, until the third quarter of 2005), Northwest (*NW*), Trans World Airlines (*TWA*, until the second quarter of 2001), United (*UA*), USAir (*US*), and Southwest (*WN*). Low cost carriers are grouped in a category labeled *LCC* (e.g., Jet Blue and Frontier are in the *LCC* group).[17] This allows us to keep small carriers that are present in only a few markets or for a few quarters when we include route–carrier fixed effects. Furthermore, it allows us to use a meaningful grouping that captures the impact of small carrier presence in the market. In the *LCC* category we exclude three low cost carriers which we choose to study independently: Airtran (*FL*), ATA (*TZ*), and National (*N7*). We do this because they either had a strong presence (Airtran) or they filed for Chapter 11 during our sample period (ATA and National).[18]

Next, we identify airlines that have filed for bankruptcy protection between 1997 and 2007. There are six carriers operating under bankruptcy protection during our sample period: United Airlines (December 9, 2002 through February 2, 2006), USAir (August 11, 2002 through March 31, 2003 and then again September 12, 2004 through September 27, 2005), ATA (October 26, 2004 through February 28, 2006), Delta (September 14, 2005 through May 1, 2007), and Northwest (September 14, 2005 through May 31, 2007). Some small carriers operated under court protection for a small time window, and thus we cannot consider

[10] In particular, Sections 1110 and 1113 of Chapter 11 facilitate these strategic changes as they allow the bankrupt carrier to adjust capacity without incurring major costs or contract violations, by granting insolvent carriers the freedom to rescind leases on gates, hangars, and aircraft, and to unilaterally modify labor agreements. For instance, Delta rejected and restructured dozens of leases at the Tampa, Dallas and Orlando airports.

[11] Repossessions have occurred for small carriers: MarkAir (second bankruptcy), Western Pacific, and Sun Country.

[12] During Continental's second bankruptcy filing 12 aircraft leasing companies agreed to defer, reduce, or forgive lease payments on 98 planes in Continental's fleet. America West negotiated rent relief on aircarfts leased from Ansett Worldwide Aviation Services. ATA returned 18 planes to lessor General Electric. Delta Airlines requested court approval to reject leases on its aircrafts.

[13] Lessors of USAir considered filing a lawsuit against the carrier. But Brad Gupta, the president of Ameriquest Holdings, a USAir lessor, publicly stated on July 25, 2002 that would leave the lessor facing lower lease rates and lower demand for rejected leases. This discouraged the lessor's lawsuit.

[14] Under United Airline's reorganization plan, the PBGC took over all four of the airline's under-funded pension plans. Immediately after filing for Chapter 11, Northwest and Delta Airlines sought court permission to cut off payments to the bulk of the retirement annuities received by thousands of former employees.

[15] When USAir's mechanics wouldn't join other unions in making voluntary concessions, the carrier's CEO, David Siegel, filed for Chapter 11. The carrier's ability to void labor contracts with the bankruptcy judge's approval allowed Siegel to win concessions from the mechanics. During United Airlines reorganization, the carrier filed a motion with the bankruptcy court to void the unions' labor contracts and impose new terms to significantly cut the carrier's expenses. Notice that Section 1113 is not specific to airlines, while Section 1110 is.

[16] A December 11, 2002 article in the WSJ reveals United's concern with reputation effects following its bankruptcy filing: "United Airlines has launched a national advertising campaign to reassure customers that it will keep flying following its bankruptcy-law filing,…The all-text, black-and-white ads assure customers that United, a unit of UAL, is honoring tickets and frequent-flier miles."

[17] For each route-year-quarter, we take the averages across the low cost carriers for the control variables.

[18] In the LCC category we include: Trans States Airlines, Aloha Airlines, Alaska Airlines, Jetblue Airways, UltrAir, Atlantic Southeast Airlines, Frontier Airlines, Tower Air, Allegiant Air, Hawaiian Airlines, Business Express, Valujet Airlines, Midway Airlines, Kiwi International, Legend Airlines, Vanguard Airlines, Spirit Air Lines, Pro Air, Pan American Airways Corp., Reno Air, Sunworld Int'l Airlines, Sun Country Airlines, Tristar Airlines, Western Pacific Airlines, Eastwind Airlines, Air South, Mesaba Airlines, Mesa Airlines, Midwest Airlines, Accessair Holdings.

these carriers independently (E.g., Independence Air operated under court protection between November 7, 2005 and January 5, *2006*).[19]

We define a market, denoted by m, as an airport-to-airport trip, *irrespective of the number of connections*.[20] A route, denoted by r, is a *non-stop* airport-to-airport trip. We consider all airport-to-airport pairs between the top 50 Metropolitan Statistical Areas (MSAs), ranked by population size.

We have four units of observation, which vary by the dataset used in each regression. First, to study the frequency of services, seats, and load factor, the unit of observation is a carrier, route, year, quarter, combination. Second, we study prices using a carrier, market, year, quarter unit of observation. Third, to study a carrier's network extent out of an airport, the unit of observation is carrier, airport, year, quarter specific. Finally, for the analysis of the number of markets served in a given quarter, by a given carrier, we use a carrier, year, quarter unit of observation.

We denote carriers by j; airports by $a=1,\ldots,A$; airport-to-airport routes by $r=1,\ldots,R$; airport-to-airport markets by $m=1,\ldots,M$; and time period by $t=1,\ldots T$. For example, the combination jrt indicates that airline j (e.g. American) transports its passengers on route r (Chicago O'Hare to Fort Lauderdale Airport) at time t (e.g. the second quarter of 2002). In the rest of the analysis, we let g denote the geographical scope of the analysis: thus, $g\in\{r, m, a, n\}$, where n indicates that the information is at the national level and the unit of observation is a carrier–year–quarter. When $g=n$ there is no cross-section variation across markets, and we only have time-series variation.

3.2. Bankruptcy categorical variables

We define the set of K carriers that filed for bankruptcy protection at some point as $\kappa=\{UA, US(1^{st}), US(2^{nd}), NW, DL, TZ, N7\}$. Notice that USAir filed for Chapter 11 twice. We use the subscript $k=1,\ldots,K$ to denote a bankrupt firm (K is equal to 7). We want to distinguish the effect that bankruptcy filings have on the quality measures we consider, for the bankrupt firm, and for its competitors, during the time when the bankrupt firm operates under Chapter 11, as well as after the firm emerges from bankruptcy protection. To measure these effects, we construct the following categorical variables. First, we define Bkt_{gt} equal to 1 if there is at least one carrier under bankruptcy protection at time t and that carrier provides service in g (for example, if $g=r$, then it provides service in route r), otherwise, Bkt_{gt} is equal to zero. For each quality measure, we study the average effect of bankruptcy across markets and across bankrupt and non-bankrupt carriers. Next, we ask whether any observed price changes during bankruptcy persist once the bankrupt firm emerges from court protection. To do this, we define the categorical variable $AftBkt_{gt}$ equal to 1 if there is at least one carrier that was under bankruptcy protection at a time before t, and that carrier currently serves g. Otherwise, $AftBkt_{gt}$ is equal to zero.

3.3. Networks, capacity, and prices

We measure the extent to which a carrier's downsizing affects the number of markets served at the national level. We use the scheduling database to construct the count of origin–destination airport pairs by operating carrier, year, and quarter. We call $NationalNetwork_{jt}$ the total number of *airport–airport combinations* served by carrier j during year–quarter t.[21] Table 2 shows that on average a carrier serves 446.14 markets over the US.

We build a measure of a carrier's network out of the airport of origin using the scheduling data. The variable $AirportNetwork_{jat}$ equals the number of routes served out of airport a, by carrier j, in year–quarter t.[22] Table 2 shows that on average a carrier serves 19 markets out of an airport.

We evaluate the flight frequency for each specific route. There has been active research on the importance of flight frequency as a determinant of air travel demand.[23] An airline that provides a single flight per day between two airports is forcing a large fraction of travelers to fly at a time which is going to be less attractive than the one offered by an airline that provides two or more flights per day between the same two airports. To construct a measure of the flight frequency between two airports, we use the scheduling database which provides information on the number of flights that each carrier schedules and performs in each market, during a year–quarter period. We compute the sum of the number of scheduled departures between two airports by operating carrier, route, year, and quarter. $Frequency_{jrt}$ equals the total number of departures performed in route r, on year–quarter t, by carrier j. Table 2 shows that on average firms offer 362.29 flights per quarter in each route.

The *T-100* Domestic Segment of Form 41 reported by the BTS provides data on an airline's capacity, measured by available seats, denoted by $Seats_{jrt}$. Table 2 shows that on average a carrier transports 45,846.46 seats per quarter.

We define a carrier's load factor on a route during a year–quarter as the ratio of the sum of all passengers transported in a market during a year–quarter to the sum of all available seats for sale on that market, during that year–quarter. We denote the load factor by $LoadFactor_{jrt}$.

To summarize the airline pricing behavior we use the median prices in a market m, denoted by $Fare_{jmt}$, to exploit information on the distribution of prices available from the DB1B dataset while using as few statistics as possible.[24] We code a round-trip ticket as *one* directional trip ticket, which costs half the full round-trip ticket fare. Fares are measured in 1993 dollars. Table 2 shows that the average fare for a one-way ticket is 126.46 dollars.

4. Identification and empirical specification

The objective of our paper is to compare route structure, prices, and capacities before, during, and after bankruptcy. The main concern is the following: As the firm sinks deeper into financial distress, it might change its strategic decisions, like prices, capacity, and network extent to generate the cash it needs to avoid bankruptcy, but this can lead the firm deeper into financial distress, and ultimately to a Chapter 11 filing. This strategy is likely to be the firm's desperate attempt

[19] We exclude TWA's third bankruptcy even though it occurred during our sample period because the firm stayed under bankruptcy protection for less than one quarter. For an analysis of prepackaged bankruptcies, see Carapeto, 2005. We also exclude Chapter 7 filings because in that case firms liquidate, and we do not have information on prices or other strategic variables under liquidation.

[20] For example, one market is Chicago O'Hare (ORD) to Washington Dulles (IAD) and another market is Chicago Midway (MDW) to Washington National (DCA).

[21] Notice that for simplicity we have omitted $g=n$ in the subscript of this variable.

[22] This is a very important variable in the empirical literature of the airline industry. In particular, it captures the relative attractiveness of an airline's frequent flyer program and its other services at the origin and destination airports (the number of ticket counters, customer service desks, etc.). See Berry (1990,1992), Berry et al. (2006), Bamberger and Carlton (2003), Brueckner et al. (1992), Ciliberto and Tamer (2009), Ciliberto and Williams (2010).

[23] Previous work looking at flight frequency as a means for airlines to differentiate their products have looked at the relationship between flight frequency and mergers (Richard, 2003), market competition (Borensteina and Netz, 1999), the nature of airline networks (Brueckner and Zhang, 2001), and economies of traffic density (Brueckner and Spiller, 1994).

[24] We drop: tickets that are neither one-way nor round-trip travel, such as open-jaw trip tickets; tickets involving a US-nonreporting carrier flying within North America and foreign carrier flying between two US points; tickets that are part of international travel; tickets including travel on more than one airline on a directional trip (known as interline tickets); tickets involving non-contiguous domestic travel (Hawaii, Alaska, and Territories); tickets with fares less than 20 dollars or larger than 9999 dollars; and tickets whose fares were in the bottom and top 5 percentile percentile in their year; tickets with more than 6 coupons. We then merge this dataset with the T-100 Domestic Segment (US Carriers) and drop tickets for flights that have less than 12 departures over a quarter in *one* direction (this means less than 1 departure every week in one direction).

Table 2
Summary statistics for the market competition variables.

	Full sample		Subsample with a bankrupt firm		Subsample without a bankrupt firm		Subsample with a firm that was previously bankrupt		Observations
	Mean	S.D.	Mean	S.D.	Mean	SD	Mean	S.D.	
National-carrier route structure (count of origin–destination airport pairs)	373	201.22	376.42	234.89	376.25	200.22	328.03	161.09	443
Airport-carrier route structure (number of routes served out of airport)	18.89	13.03	19.12	13.63	18.79	12.91	19.99	13.75	26,115
Route–carrier flight frequency (number of departures in a route)	362.29	379.01	348.10	267.05	365.71	391.01	318.50	257.38	194,709
Route–carrier number of Seats (number of seats transported)	45846.46	43310.19	44451.93	42729.6	46170.05	43540.18	41753.89	39444.12	194,709
Route–carrier load factor (passengers over seats)	0.671	0.142	0.741	0.125	0.662	0.142	0.753	0.124	194,709
Market–carrier median fare ($1993)	126.19	39.41	118.919	34.114	126.878	40.175	126.82	34.74	493,436
United Airlines is under Chapter 11 bankruptcy protection (0/1)	0.14	0.35							
USAir is under Chapter 11 bankruptcy protection, first filing (0/1)	0.02	0.14							
USAir is under Chapter 11 bankruptcy protection, second filing (0/1)	0.03	0.16							
Delta Airlines is under Chapter 11 bankruptcy protection (0/1)	0.10	0.30							
Northwest Airlines is under Chapter 11 bankruptcy protection (0/1)	0.07	0.25							
ATA is under Chapter 11 bankruptcy protection (0/1)	0.01	0.10							
National Airlines is under Chapter 11 bankruptcy protection (0/1)	0.00	0.05							

to raise cash to avoid the bankruptcy filing, and therefore, it is likely to occur in the period immediately preceding bankruptcy. As a result of this pre-bankruptcy behavior, we might estimate a lower pre-bankruptcy average price just because of the rapid drop in prices in the quarters before the bankruptcy filing.

This problem is conceptually the same as the one in Ashenfelter (1978). In a study of the effect of training programs on earnings Ashenfelter noted that all trainees suffered unpredicted earning declines in the year prior to entering a training program (see Ashenfelter, 1978, page 51). This stylized fact has become known as the "Ashenfelter dip." Simple comparisons of earnings before and after the training program would be misleading evidence of the effect of training on earnings. To deal with this, Ashenfelter dropped the period immediately preceding training (see Ashenfelter, 1978, page 53). The analogy with our problem of prices and bankruptcy filing is clear: Prices could fall prior to bankruptcy and this would dampen the differences in the prices before, during, and after the bankruptcy filing.

We follow Ashenfelter (1978) and drop observations corresponding to two quarters prior to the to-be-bankrupt firm's bankruptcy filing date and corresponding to markets where this firm was present.[25] To further address this concern, we apply a dynamic program evaluation approach: We look at the average values of the variable of interest (e.g. price) one quarter before, two quarters before, and three quarters before the firm's bankruptcy filing. The key point is to see whether there is evidence of significant changes in prices preceding the bankruptcy filing. Next, we worry about the possibility of persistent correlation of negative unobserved current and expected demand shifts (that extend beyond the pre-bankruptcy period we eliminate) in markets served by the bankrupt airlines relative to that in markets served by other airlines. We address this second concern by following Friedberg (1998), and include linear market time trends to control for such market-specific unobservable correlations across time. Further, price changes triggered by demand changes spurring from seasonal or exogenous shocks (e.g. increases in fuel costs or 9/11) can confound the effects of bankruptcy on prices. Serially correlated industry-specific shocks to demand can also confound the effects of bankruptcies on prices. To address this, we include year–quarter fixed effects. Furthermore, a carrier flying on a certain time schedule might benefit business travel in some markets but not in others, affecting the price behavior of that carrier in those markets, but not in others.[26] Ignoring these sources of unobservable heterogeneity associated with an airline's pricing behavior can confound the effects of bankruptcy filings on prices. To address this, we include route–carrier fixed effects. Finally, a carrier's presence in a market can have an effect on the behavior of other carriers in that market, regardless of whether the carrier is bankrupt. Thus, we differentiate the effect of a bankruptcy filing from the effect that just the presence of a firm in the market has by including the categorical variable IN_{gt}. The variable IN_{gt} switches on when at least one bankrupt firm is in g (recall that if $g=r$, then we would say that at least one bankrupt firm is in route r) at time t. This variable is likely a function of the same unobservables that affect the pricing decisions. This leads us to discuss the issue of sample selection.

There are two sources of sample selection. The first is related to the self-selection of the firms into markets. In the literature, this problem is addressed by following Veerbek and Nijman (1992), who consider the selectivity bias of the fixed and random effects estimators and show that the fixed effect estimator is more robust to nonresponse biases than the random effects estimator. The second sample selection issue refers to the selection of markets, since we do not have a balanced panel. Thus, following Veerbek and Nijman (1992), we need to use market fixed effects. In this paper, we include route–carrier or market–carrier fixed effects to address this concern, which clearly control for market (or route) and carrier fixed effects. To study the empirical importance of sample selection we present results when we run regressions with random effects and compare them with the results we obtain when we include fixed effects. We show that sample selection is not an issue of empirical significance in our analysis, since the results are not different.

[25] We repeat the analysis excluding the preceding 4 quarters and find qualitatively similar results.

[26] Another example: A carrier in a given market might use more modern planes than other carriers in that market, affecting the price that all carriers in that market can charge.

We estimate the following econometric specification:

$$lnQ_{jgt} = \alpha^{OWN} Bkt_{gt}^{Own} + \alpha^{OTH} Bkt_{gt}^{Others} + \beta^{OWN} AftBkt_{gt}^{Own} + \beta^{OTH} AftBkt_{gt}^{Others} + \varepsilon_{jgt}, \quad (1)$$

where ε_{jgt} is the remaining component of the regression to be discussed in detail below. Here, Q_{jgt} is one of the measures discussed in Section 3.3: $NationalNetwork_{jt}$, $AirportNetwork_{jat}$, $frequency_{jrt}$, $Seats_{jrt}$, $Fare_{jmt}$, and $LoadFactor_{jrt}$. These dependent variables are run on two sets of bankruptcy categorical variables. The first indicates whether a competitor in a market *currently operates* under bankruptcy protection, and the second indicates whether any of the firms competing in a market *previously operated* under bankruptcy.

The coefficient α^{OWN} measures the current effect of a bankruptcy filing on the bankrupt firm's variable Q_{jgt}. The current effect on the bankrupt's firm competitors is measured by α^{OTH}. The post-bankruptcy effects are measured by β^{OWN} and β^{OTHER}. Table 3 illustrates how we identify the parameters of the regression. Note that changes *after* a firm's bankruptcy are computed over *all quarters from the firm's bankruptcy emergence until the end of the sample period*, and in the case of USAir that has multiple bankruptcy filings over quarters from one bankruptcy emergence until the next bankruptcy filing. Similarly, the *pre-bankruptcy period* is defined as *all quarters between the beginning of the sample period until the firm's bankruptcy filing*; and for the second USAir bankruptcy it is over the quarters between filings.

We let ε_{jgt} be defined as follows:

$$\varepsilon_{jgt} = u_t + u_{jt} \text{ if } g = n(\text{unit of observation is carrier–year–quarter}),$$
$$\varepsilon_{jgt} = \gamma ln_{gt} + u_{jg} + u_t + u_{jgt} + \theta_{o(g)} o(g)_{gt} \cdot Trend_t + \theta_{d(g)} d(g)_{gt} \cdot Trend_t \text{ if } g = r, m,$$
$$\varepsilon_{jgt} = \gamma ln_{at} + u_{ja} + u_t + u_{jat} + \theta_a \cdot a \cdot Trend_t \text{ if } g = a.$$

In_{gt} is the variable that controls for whether one of the firms that is filing for bankruptcy is in g at any point in time; u_{jg} is a g-carrier fixed effect, for example a route–carrier fixed effect when we look at prices; u_t is a year–quarter fixed effect; and u_{jgt} is an idiosyncractic unobservable. $Trend_t$ is a time trend variable, taking values from 1 to 48. $\theta_{o(g)}$ is the parameter of the origin-specific time trend, where $o(g)$ is the origin airport of route r or market m. $\theta_{d(g)}$ is defined similarly. θ_a is the parameter of the origin-specific time trend when the unit of observation is the airport–year–quarter. We cluster observations as recommended by Bertrand et al. (2004), who show that without the appropriate clustering, fixed effect regressions produce inconsistent standard errors.[27] In addition, we report the marginal effect corresponding to the coefficient of the dummy variables in the semilogarithmic regression equations.[28]

[27] The appropriate clustering depends on how we think that airlines behave. If, as assumed by the literature (for example, Berry, 1990; Berry and Jia, 2010; Borenstein, 1989; Brueckner et al., 1992) airlines treat each route as an independent regional market then the clustering should be by route. This is what Kristopher and Shapiro (2009) do in their recent work. We follow their approach and in all of our regressions we cluster the unobservables by route if the unit of observation is the route–carrier–year–quarter. We cluster by airport if the unit of observation is the airport–carrier–year–quarter. And we cluster by market if the unit of observation is the market–carrier–year–quarter.

[28] In order to interpret the coefficients of the dummy variables in the semilogarithmic regression equation above we need to transform the estimates. This is because in a semilog regression the coefficient of a dummy variable, multiplied by 100, is *not* equal to the percentage effect of that variable on the variable being explained. Halvorsen and Palmquist (1980) show that to give the estimated coefficient a percentage interpretation, we need to transform the coefficient as follows. If the estimated coefficient is $\hat{\alpha}^{OWN}$ then the percentage effect of Bkt_{rt}^{Own} on Q_{jrt} is $\tilde{\alpha}^{OWN} = exp(\hat{\alpha}^{OWN}) - 1$.We report the estimated coefficient and the correct percentage effect in the tables. The latter is reported in squared brackets below the standard errors.

Table 3
The parameters measuring the effect of bankruptcy filings.

Time	UA is bankrupt	UA is in market	Effect on UA	Effect on AA
−1	0	1	0	0
0	1	1	α^{OWN}	α^{OTHER}
1	1	1	α^{OWN}	α^{OTHER}
2	1	0	0	0
3	0	1	β^{OWN}	β^{OTHER}
4	0	0	0	0

5. The effect of bankruptcy filings on airline networks

5.1. National networks

The dependent variable for Eq. (1) in Table 4, is the natural logarithm of $NationalNetwork_{jt}$ and equals the number of origin and destination airport pairs served by carrier j at time t. In this specification we do not include year–quarter fixed effects because we cannot use variation in the identity and number of participants in a local market to identify the effect of bankruptcy filings. Here, the level of geographical detail is the whole US.

Column 1 presents the main specification, where we include carrier fixed effects and we drop observations corresponding to two quarters prior the filings. We estimate α^{OWN} equal to −0.233; α^{OTHER} equal to 0.256; β^{OWN} equal to −0.471; finally, β^{OTHER} equal to 0.259. They are all precisely estimated.

The economic significance of each coefficient can be gauged by looking at the corresponding square bracket, which reports the transformed coefficient as described above. In particular, α^{OWN} equal to −0.233 means that on average firms reduce the number of markets that they serve by 20.8 percentage when they are under Chapter 11.[29] After emerging from bankruptcy protection, firms that filed for bankruptcy protection serve 37.5 percentage fewer of the markets that they were serving before filing for Chapter 11 To understand why we find such a strong effect, recall that our unit of observation is a carrier–year–quarter. So, each carrier is approximately weighted in an equal way when we estimate the average coefficients. This means that the changes in the number of markets implemented by small carriers carry as much weight as the ones implemented by the large carriers in the coefficient estimates. To see why this observation is important, in Column 2 we exclude ATA from the dataset. Immediately we notice that the estimate of β^{OWN} drops to −0.275, which corresponds to a change of −24% in the number of markets served.

Now consider the effect of bankruptcy filings on the number of markets served by the rivals of the bankrupt firms. We find that the rivals increase the number of the markets they serve by almost 30%. This change is permanent. Again this effect is very large. In the other columns we will see that such effect is closer to 20%. Column 3 presents the results when we do not use Ashenfelter's solution, that is we do not drop observations corresponding to two quarters prior the filings. The results are similar to those in Column 1, which is the first piece of evidence that the endogeneity of the bankruptcy dummies is not empirically significant. Column 4 presents the results when we also exclude the carrier fixed effects. Notice that the parameters are estimated almost equal to those in Column 3, suggesting that firm specific heterogeneity is not a concern in the empirical question that we address in this paper.

We conclude the table with Column 5, where we follow a dynamic program evaluation approach. Instead of dropping observations corresponding to two quarters prior to the filing, we add lag values of the bankruptcy categorical variables. Formally, we estimate the coefficients of $Bkt_{g,t-1}^{Own}$, $Bkt_{g,t-2}^{Own}$, $Bkt_{g,t-1}^{Others}$, and $Bkt_{g,t-2}^{Others}$. If the bankruptcy

[29] The percentage effect is calculated as above, $\tilde{\alpha}^{OWN} = exp(-0.595) - 1 = 44.8\%$.

Table 4
The impact of Chapter 11 filings on national-carrier route structure. The dependent variable is the natural logarithm of the total number of airport–airport combinations served by carrier j during year–quarter t.

α^{OWN}, in-bankruptcy effect on bankrupt firm's national route structure	−0.595**	−0.530**	−0.307**	−0.154	−0.548**
	(0.095)	(0.079)	(0.068)	(0.128)	(0.081)
	[−0.448]	[−0.411]	[−0.264]	[−0.143]	[−0.422]
α^{OTHER}, post-bankruptcy effect on bankrupt firm's national route structure	−1.063**	−1.013**	−0.647**	−0.336*	−1.035**
	(0.109)	(0.103)	(0.083)	(0.149)	(0.104)
	[−0.654]	[−0.637]	[−0.476]	[−0.285]	[−0.645]
β^{OWN}, in-bankruptcy effect on the national route structure of the rivals	0.122	0.147	0.115**	0.008	0.150
	(0.213)	(0.173)	(0.038)	(0.079)	(0.173)
	[0.130]	[0.158]	[0.122]	[0.008]	[0.161]
β^{OTHER}, in-bankruptcy effect on the national route structure of the rivals	−0.074	−0.099	0.376**	0.217*	−0.112
	(0.196)	(0.170)	(0.043)	(0.085)	(0.176)
	[−0.071]	[−0.094]	[0.456]	[0.242]	[−0.106]
One period lag in-bankruptcy effect on bankrupt firm's national route structure					−0.016
					(0.269)
One period lag in-bankruptcy effect on bankrupt firm's national route structure					0.005
					(0.452)
Two periods lag in-bankruptcy effect on bankrupt firm's national route structure					−0.041
					(0.198)
Two periods lag in-bankruptcy effect on bankrupt firm's national route structure					0.239
					(0.327)
Observations	363	443	443	443	443
Carrier fixed effects	Yes	Yes	Yes	No	Yes
Year–quarter fixed effects	Yes	Yes	No	No	Yes
2 prior quarters excluded	Yes	No	No	No	No
Within R^2	0.824	0.824	0.787	0.038	0.826

Standard errors in parentheses; **p<0.01, *p<0.05.

dummies are exogenous, the results should be the same in Column 1 and Column 5. Moreover, the lag bankruptcy dummies should be neither statistically nor economically significant. This is exactly what we find.

Overall, the results suggest that there is very strong impact of bankruptcy filings on the number of markets served by bankrupt firm, but and on the number of markets served by its rivals. When looking at these results we need to keep in mind that no time specific controls (i.e. year–quarter fixed effects) are included in the estimation because we cannot separately estimate the effect of the time variables and that of the bankruptcy dummies. Next, we will consider the case where we use variation in local markets and then we can see how robust this first set of results is to more controls.

5.2. Airport networks

In Table 5 the dependent variable is the natural logarithm of $AirportNetwork_{jat}$. Recall that this is the natural logarithm of the total number of markets served by carrier j out of airport a at time t.

Column 1 presents the results under the main specification, where we include airport-carrier fixed effects; year–quarter fixed effects; origin specific time trends; and we drop observations corresponding to

Table 5
The impact of Chapter 11 filings on airport-carrier route structure. The dependent variable is the natural logarithm of the total number of markets served out of airport a, by carrier j in the year–quarter t.

α^{OWN}, in-bankruptcy effect on bankrupt firm's route structure	−0.302**	−0.291**	−0.286**	−0.176**	−0.308**
	(0.037)	(0.034)	(0.034)	(0.031)	(0.035)
	[−0.261]	[−0.252]	[−0.249]	[−0.161]	[−0.265]
α^{OTHER}, post-bankruptcy effect on bankrupt firm's route structure	−0.270**	−0.283**	−0.278**	−0.213**	−0.286**
	(0.065)	(0.061)	(0.061)	(0.052)	(0.062)
	[−0.237]	[−0.246]	[−0.243]	[−0.192]	[−0.249]
β^{OWN}, in-bankruptcy effect on the route structure of the rivals	−0.136**	−0.127**	−0.108**	0.095**	−0.127**
	(0.027)	(0.022)	(0.022)	(0.014)	(0.022)
	[−0.127]	[−0.119]	[−0.102]	[0.099]	[−0.119]
β^{OTHER}, in-bankruptcy effect on the route structure of the rivals	0.080*	0.076**	0.083**	0.109**	0.071**
	(0.037)	(0.030)	(0.037)	(0.015)	(0.031)
	[0.083]	[0.079]	[0.086]	[0.115]	[0.073]
One period lag in-bankruptcy effect on bankrupt firm's route structure					−0.202
					(0.193)
One period lag in-bankruptcy effect on the route structure of the rivals					0.051
					(0.027)
Two periods lag in-bankruptcy effect on bankrupt firm's airport route structure					−0.212**
					(0.026)
Two periods lag in-bankruptcy effect on bankrupt firm's route structure					−0.028
					(0.020)
Observations	22,318	26,115	26,115	26,115	33,788
Number of route–carrier groups	716	718	718	718	1173
Airport-carrier fixed effects	Yes	Yes	Yes	Yes	Yes
2 prior quarters excluded	Yes	No	No	No	No
Origin time trends	Yes	Yes	No	No	Yes
Year–quarter fixed effects	Yes	Yes	Yes	No	Yes
Within R^2	0.148	0.141	0.091	0.028	0.144

Standard errors in parentheses; **p<0.01, *p<0.05. Standard errors clustered by airport.

two quarters prior the filings. With $AirportNetwork_{jat}$ as the dependent variable we estimate α^{OWN} equal to −0.302 and β^{OWN} equal to −0.270. Both of these parameters are estimated precisely, and they should be interpreted as corresponding to a 25% drop in the bankrupt carrier's network extent out of airports during and after the filing. Interestingly the rivals of the bankrupt carrier also lower their network extent during bankruptcy filings, but increase it by 8% after the emergence of the bankrupt firm from Chapter 11. The effects on the rivals are thus much smaller than what we found in Table 4. This suggests that aggregate time shocks, such as 9/11, are important determinants of the number of markets served by carriers.

Column 2 reports the results when we do not drop observations corresponding to two quarters prior the filings. The results are analogous to those in Column 1, again confirming that the potential endogeneity of the bankruptcy dummies, while in theory a serious concern, in practice is not empirically significant. Column 3 reports estimates from a regression that excludes origin–time trends. We notice that the results are the same as those in Columns 1 and 2, suggesting that, at least for this dependent variable there is no reason to be concerned about persistent correlation of negative unobserved current and expected demand shifts (that extend beyond the pre-bankruptcy period we eliminate) at airports served by the bankrupt airlines relative to other airports. In Column 4 we exclude carrier–origin fixed effects. So this is a random effect regression, where the random component is a carrier–origin unobservable. Notice that the estimated coefficients are remarkably smaller in this column than in Columns 1–3, where we include fixed effects. This confirms the finding of Table 4 that heterogeneity across carriers is significant. In Column 5 we implement a dynamic program evaluation approach, along the same lines as in Column 5 of Table 4. First, we observe that the estimates of α^{OWN}, α^{OTH}, β^{OWN}, and β^{OTH} are the same as in Column 1. This again suggests that the estimated coefficients are not biased by the potential endogeneity of the bankruptcy dummies. Second, we notice that one of the lagged dummies is statistically significant and its magnitude is quite large. We interpret this as evidence that, prior to bankruptcy, the insolvent firm implements changes in its network extent, but the magnitude of such changes are not precisely estimated.

Overall the results of Table 5 confirm a strong effect of bankruptcy filings on the route structure of airline firms. Bankrupt carriers drop markets at all their airports, with an average change of approximately 25%. This is clearly a strong effect.

6. The effect of bankruptcy filings on capacity choices

6.1. Flight frequency

The dependent variable for the regression Eq. (1) in Table 6 is the natural logarithm of $Frequency_{jrt}$, where frequency is defined as the total number of flights served by carrier j in the route r at time t (a year–quarter).

Column 1 presents the results of the main specification, when we include route–carrier fixed effects, year–quarter fixed effects, origin and destination specific time trends, and we drop observations corresponding to two quarters prior the filings. We estimate α^{OWN} equal to −0.242 and β^{OWN} equal to −0.397, both statistically significant. In contrast, α^{OTH} and β^{OTH} are small and imprecisely estimated. The estimates of α^{OWN} and β^{OWN} show that bankrupt carriers drop the number of flights in the routes they serve by 21.5% during the bankruptcy filing and by 32.8 after their emergence from Chapter 11. The results in Column 2, where we do not drop observations corresponding to two quarters prior the filings, suggest that there is no much evidence of an endogeneity bias of the bankruptcy dummies, since the results are the same as in Column 1. Similarly, the results in Column 3, where we exclude the origin and destination specific time trends are also essentially the same as in Column 1. The results in Column 4 show that year–quarter fixed effects are crucial to identify the effect of bankruptcy filing on flight frequency. If we do not include year–quarter fixed effects, we find that frequency drops by 13.7% instead of 21.5% during the filing. We find that frequency drops by 23.3% instead of 32.8% after the emergence from bankruptcy. Thus, there are temporal shocks that play an important role in determining the frequency decisions, which can confound the effect of bankruptcy filings on frequency. Instead, Column 5 shows that route–carrier fixed effects are not crucial for the results. Thus, unobserved heterogeneity across route–carriers is not as

Table 6
The impact of Chapter 11 filings on route–carrier flight frequency. The dependent variable is the natural logarithm of the number of departures performed in route r, on year–quarter t, by carrier j.

α^{OWN}, in-bankruptcy effect on bankrupt firm's frequency	−0.242*	−0.243*	−0.247*	−0.147*	−0.241*	−0.238*
	(0.0164)	(0.015)	(0.015)	(0.012)	(0.016)	(0.016)
	[−0.215]	[−0.216]	[−0.219]	[−0.137]	[−0.214]	[−0.212]
α^{OTHER}, post-bankruptcy effect on bankrupt firm's frequency	−0.397*	−0.398*	−0.404*	−0.265*	−0.392*	−0.396*
	(0.025)	(0.024)	(0.0241)	(0.020)	(0.025)	(0.025)
	[−0.328]	[−0.328]	[−0.332]	[−0.233]	[−0.324]	[−0.327]
β^{OWN}, in-bankruptcy effect on the frequency of the rivals	−0.014	−0.013	0.005	0.079*	−0.021	−0.009
	(0.015)	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)
	[0.014]	[0.013]	[0.005]	[0.082]	[−0.021]	[−0.009]
β^{OTHER}, in-bankruptcy effect on the frequency of the rivals	−0.019	−0.026	0.011	0.123	−0.031	−0.025
	(0.019)	(0.018)	(0.019)	(0.017)	(0.018)	(0.018)
	[−0.019]	[−0.026]	[0.011]	[0.131]	[−0.030]	[−0.025]
One period lag in-bankruptcy effect on bankrupt firm						−0.037*
						(0.011)
One period lag in-bankruptcy effect on rivals						0.000
						(0.016)
Two periods lag in-bankruptcy effect on bankrupt firm						0.051
						(0.012)
Two periods lag in-bankruptcy effect on bankrupt firm						0.028*
						(0.015)
Observations	188,610	194,709	194,709	194,709	188,610	194,709
Number of route–carrier groups	7328	7344	7344	7344	7328	7344
Route–carrier fixed effects	Yes	Yes	Yes	Yes	No	Yes
2 prior quarters excluded	Yes	No	No	No	Yes	No
Origin & destination time Trends	Yes	Yes	No	No	Yes	Yes
Year–quarter fixed effects	Yes	Yes	Yes	No	Yes	Yes
Within R^2	0.074	0.074	0.029	0.013	0.073	0.074

Standard errors in parentheses; *p<0.01. Standard errors clustered by route.

important as in Tables 4 and 5. In Column 6 we implement a dynamic program evaluation approach. There is some small evidence that the bankrupt firm might have started to change its flight frequency before the filing, but those changes were minimal, compared to those during and after the bankruptcy filing. Notice that the estimates of the main parameters, are the same as in Column 1. Together with the results in Columns 1 and 2, this suggests that the bankruptcy dummies are not endogenous in this regression.

6.2. Capacity

The dependent variable for the regression Eq. (1) in Table 7 is the natural logarithm of $Seats_{jrt}$, which is the total number of seats served by carrier j in the route r at time t.

Column 1 presents the results of the main specification, when we include route–carrier fixed effects, year–quarter fixed effects, origin and destination specific time trends, and we drop observations corresponding to two quarters prior the filings. We estimate α^{OWN} equal to −0.351 and β^{OWN} equal to −0.426, both statistically significant. α^{OTH} is estimated equal to −0.036 and β^{OTH} equal to −0.059, and both are precisely estimated. In economic terms this means that bankrupt firms drop their capacity (seats) by 29.6% during the bankruptcy filing and by 34.7% after the emergence from Chapter 11. Their rivals drop some of their capacity, but the effect is much smaller, around 5% both during and after the bankruptcy filing. *Columns 2–5* show that the results do not change if we do not drop observations corresponding to two quarters prior the filings, if we drop the origin and destination time trends, if we drop year–quarter fixed effects, and if we drop route–carrier fixed effects. *Columns 6* shows that a dynamic program evaluation approach leads to identical results. Again, there is no evidence that the bankruptcy dummies are endogenous, or, at the very least, their endogeneity is not empirically important.

7. The effect of bankruptcy filings on prices

In this section we reconcile the evidence on the effects of Chapter 11 on capacity and network structure with the evidence on prices. We ask the following questions: How do prices change? What happens to the demand faced by the bankrupt firm? Finally, what are the effects of the bankruptcy filings on the marginal costs of transporting a passenger?

The dependent variable for the regression Eq. (1) in Table 8 is the natural logarithm of $Fare_{jmt}$, which is the median price charged by carrier j in market m at time t.

Column 1 reports results when we include market–carrier fixed effects, year–quarter fixed effects, origin and destination specific time trends, and we drop observations corresponding to two quarters prior the filings. Our estimate of α^{OWN} equals −0.031 and β^{OWN} equals 0.044. This means that firms lower their prices by 3% while under bankruptcy protection, and raise them by 4.4% after their emergence from Chapter 11. We find that the rivals do not change their price in any statistically or economically significant way, and this result is robust across the six specifications in Table 8.

The most surprising result here is that prices actually *increase* after the emergence from bankruptcy protection. That is the first indication that bankruptcy filings might not effectively reduce the (marginal) costs of operation.

Column 2 reports the results when we do not drop observations corresponding to two quarters prior the filings. The results are indistinguishable from those in *Column 1*. The results in *Column 3* show that persistent correlation of negative unobserved, current and expected, demand shifts is an important concern. The estimated effects on prices are very different in *Columns 1* and *3*. In Column 1 we estimated α^{OWN} equal to −0.031, while now it is equal to −0.056, almost twice as large. The difference in the estimated β^{OWN} is even larger. In Column 1, we estimated β^{OWN} equal to 0.044, while in Column 3 we estimate β^{OWN} equal to −0.010. We will return to this unobserved correlation when we study the results presented in Column 6, where we show that the linear trends adequately control for it. Column 4 excludes year–quarter fixed effects, and this significantly alters our results. The coefficient α^{OWN} equals −0.093, which would mean that under in-bankruptcy airline firms charge prices that are almost 10% lower than in the pre-bankruptcy period. β^{OWN} equals −0.032, suggesting that some part of the price drop is permanent. Clearly, the conclusions of our analysis would be different if we did not control for unobserved temporal shocks, such as 9/11: We

Table 7
The impact of Chapter 11 filings on route–carrier number of seats (capacity). The dependent variable is the natural logarithm of the total number of seats transported in route r, on year–quarter t, by carrier j.

α^{OWN}, in-bankruptcy effect on bankrupt firm's route–carrier capacity	−0.351***	−0.340***	−0.344***	−0.315***	−0.350***	−0.339***
	(0.019)	(0.018)	(0.018)	(0.017)	(0.019)	(0.019)
	[−0.296]	*[−0.288]*	*[−0.291]*	*[−0.270]*	*[−0.295]*	*[−0.287]*
α^{OTHER}, post-bankruptcy effect on bankrupt firm's route–carrier capacity	−0.426***	−0.419***	−0.377***	−0.324***	−0.417***	−0.418***
	(0.027)	(0.026)	(0.026)	(0.022)	(0.027)	(0.026)
	[−0.347]	*[−0.342]*	*[−0.314]*	*[−0.277]*	*[−0.341]*	*[−0.341]*
β^{OWN}, in-bankruptcy effect on the route–carrier capacity of the rivals	−0.036**	−0.031**	0.008	0.024	−0.047***	−0.029*
	(0.017)	(0.016)	(0.016)	(0.015)	(0.016)	(0.016)
	[−0.035]	*[−0.030]*	*[0.008]*	*[0.024]*	*[−0.046]*	*[−0.028]*
β^{OTHER}, in-bankruptcy effect on the route–carrier capacity of the rivals	−0.059***	−0.067***	0.020	0.068***	−0.077**	−0.067***
	(0.021)	(0.020)	(0.023)	(0.020)	(0.021)	(0.021)
	[−0.057]	*[−0.065]*	*[0.020]*	*[0.070]*	*[−0.074]*	*[−0.065]*
One period lag in-bankruptcy effect on the bankrupt firm's route–carrier capacity						−0.044***
						(0.014)
One period lag in-bankruptcy effect on the route–carrier capacity of the rivals						−0.002
						(0.017)
Two periods lag in-bankruptcy effect on the bankrupt firm's route–carrier capacity						0.029**
						(0.014)
Two periods lag in-bankruptcy effect on the route–carrier capacity of the rivals						0.015
						(0.017)
Observations	188,610	194,709	194,709	194,709	188,610	194,709
Number of route–carrier groups	7324	7344	7344	7344	7328	7344
Route–carrier fixed effects	Yes	Yes	Yes	Yes	No	Yes
2 prior quarters excluded	Yes	No	No	No	No	No
Origin & destination time trends	Yes	Yes	No	No	No	Yes
Year–quarter fixed effects	Yes	Yes	Yes	No	No	Yes
Within R^2	0.095	0.094	0.029	0.023	0.094	0.094

Standard errors in parentheses; ***p<0.01, **p<0.05, *p<0.1. Standard errors clustered by route.

Table 8
The impact of Chapter 11 filings on market–carrier prices. The dependent variable is the natural logarithm of the median fare charged in market m, in year–quarter t, by carrier j.

	(1)	(2)	(3)	(4)	(5)	(6)
α^{OWN}, in-bankruptcy effect on the bankrupt firm's market–carrier prices	−0.031***	−0.030***	−0.056***	−0.093***	−0.031***	−0.037***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
	[−0.030]	[−0.259]	[−0.054]	[−0.089]	[−0.030]	[−0.036]
α^{OTHER}, post-bankruptcy effect on the bankrupt firm's market–carrier prices	0.044***	0.045***	−0.010***	−0.032***	−0.041***	0.042***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
	[0.045]	[0.046]	[−0.010]	[−0.031]	[−0.040]	[0.043]
β^{OWN}, in-bankruptcy effect on the market–carrier prices of the rivals	−0.005*	−0.005	−0.015***	−0.057***	−0.003	−0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
	[−0.005]	[−0.005]	[−0.015]	[−0.055]	[−0.003]	[−0.006]
β^{OTHER}, in-bankruptcy effect on the market–carrier prices of the rivals	0.008	0.006	−0.011***	−0.010***	0.007**	0.007***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
	[0.008]	[0.006]	[−0.011]	[−0.010]	[0.007]	[0.003]
One period lag in-bankruptcy effect on the bankrupt firm						−0.028***
						(0.003)
One period lag in-bankruptcy effect on the rivals						−0.012***
						(0.002)
Two periods lag in-bankruptcy effect on the bankrupt firm						−0.023***
						(0.003)
Two periods lag in-bankruptcy effect on the rivals						−0.005
						(0.002)
Three period lag in-bankruptcy effect on the bankrupt firm						−0.019***
						(0.003)
One period lag in-bankruptcy effect on the rivals						−0.001
						(0.002)
Observations	448,683	493,436	493,436	493,436	448,683	493,436
Number of market-group groups	21,688	21,844	21,844	21,844	21,688	21,844
Market–carrier fixed effects	Yes	Yes	Yes	Yes	No	Yes
2 prior quarters excluded	Yes	No	No	No	No	No
Origin & destination time trends	Yes	Yes	No	No	No	Yes
Year–quarter fixed effects	Yes	Yes	Yes	No	No	Yes
Within R^2	0.159	0.165	0.125	0.030	0.157	0.166

Standard errors in parentheses; ***p<0.01, **p<0.05, *p<0.1. Standard errors clustered by market.

would conclude that bankruptcy filings lead to lower prices both during and after the time when a firm is under Chapter 11 protection. In Column 5 we report results for a specification with route–carrier random effects. The results are essentially identical to those in Column 1. This means that the changes in prices are estimated to be the same whether we use variation in prices in markets where bankrupt airlines are present *before*, *during*, and *after* a bankruptcy filing or whether we use variation in prices in all markets. This is important for two reasons. First, it suggests that there are no selection problems since the results are the same whether or not we include route–carrier fixed effects. Second, this eliminates the unlikely but potentially troubling possibility that identification is just off routes that airlines keep while in bankruptcy but drop them upon emerging. Column 6 presents the results when we follow a dynamic program evaluation approach. Recall that this approach is useful to see the extent to which prices set by bankrupt firms are different on time-varying unobservables that are not adequately captured by either the year–quarter fixed effects or origin/destination linear trends. Given the magnitude of the results for prices, we include three lags, instead of two as in the previous tables. First, we find that α^{OWN} and β^{OWN} take the same values as in Column 1. Second, we notice that the lagged variables are small in magnitude and decline as we move further back in time from the bankruptcy filing date. Thus, we conclude that there might still be some difference on time-varying unobservables which is not picked up by the year–quarter fixed effects or by the origin/destination linear trends, but such difference does not significantly affect the estimates of the parameters α^{OWN} and β^{OWN}.

Next, we ask what is the effect of bankruptcy on a carrier's load factor. A carrier's load factor is the ratio of passengers flown over the number of seats, by a carrier j, in route r, in year–quarter t, and captures airline j's capacity utilization. This is interesting because the load factor is an indicator that tells us about the demand faced by the airlines for the following reason. We know that the bankruptcy carrier dropped its capacity and prices did not change much. If the load factor remains unchanged or is smaller, then this means that the bankrupt carrier must be facing a lower demand. If the load factor increased, then this means that the bankrupt carrier might have actually experienced an increase in its demand.

Table 9 considers the case where the dependent variable is the natural logarithm of the load factor of carrier j, in route r, at year–quarter t, $LoadFactor_{jrt}$. We only run one specification, where we include market–carrier fixed effects, year–quarter fixed effects, origin and destination specific time trends, and we drop observations corresponding to two quarters prior the filings.

Columns 1 and 2 of Table 9 show that the bankrupt firm's load factor *declines* during *and* after its bankruptcy filing. We know from Table 7 that the bankrupt firm decreases the number of seats available. Together, these results suggest that the bankrupt carrier's demand fell, and though the firm decreased capacity and price during bankruptcy, the

Table 9
The impact of Chapter 11 filings on route–carrier load factor. A carrier's load factor is defined as the ratio of passengers flown to offered seats, by a carrier j, in route r, on year–quarter t. It measures the airline's utilization of capacity. For example, a load factor of 1 indicates that the carrier fills the plane fully, selling every available seat on the plane. The mean load factor in the full sample is 0.671.

	Own effect		Effect on competitors	
	During	After	During	After
At least on carrier in the route is bankrupt	−0.011*	−0.0141*	0.029*	0.036*
	(0.004)	(0.005)	(0.004)	(0.006)
Observations	188,610			
Number of route–carrier groups	7328			
Within R^2	0.223			

Standard errors in parentheses; *p<0.01. Standard errors clustered by route.
The regression includes year–quarter fixed effects; origin and destination time trends; route–carrier fixed effects. We drop observations corresponding to two quarters prior the filings.

price fall was not enough to generate a high capacity utilization rate (load factor). The load factor of the competitors increases, suggesting an unambiguous shift in demand towards non-bankrupt carriers. The effect on the bankrupt carrier's demand is somewhat reversed after the firm emerges from bankruptcy, since the emerging carrier is able to increase prices by more than 5% even though its planes are not as fully utilized as before the filing.

7.1. Prices and marginal costs

To investigate further why prices do not change much during and after bankruptcy filings, we study the marginal cost of transporting a passenger. Recall that a Chapter 11 filing can grant the bankrupt firm a cost advantage over its competitors, potentially explaining the marginal fall in prices observed while the firm operates under bankruptcy. Cost savings are expected to last even after the firm emerges from bankruptcy, or at least for a short time following the firm's emergence. To investigate the explanatory power of cost driven price changes, we study changes in the marginal cost of a seat before, during, and after each bankruptcy filing. Before we discuss this alternative explanation, it is useful to discuss in more detail the nature of marginal costs in the airline industry, and the distinction between accounting and economic opportunity cost.

The accounting marginal cost of a seat is just the passenger cost associated with issuing tickets, processing passengers through the gate, in-flight food and beverages, and insurance and other liability expenses. This cost is very small relative to the fixed costs faced by an airline to fly a plane on a route. However, as Elzinga and Mills, 2009 convincingly argue, the economic opportunity cost is the price of the ticket that could have been charged to another passenger to fly on that same plane but through a connection between two different airports. This measure of the economic marginal cost is not observable because we do not have the information to know what passengers the airline could have flown on that same seat. Yet, we know the lowest price that the airline charged in a quarter. The idea here is that a reasonable approximation of the economic marginal cost is the lowest ticket fare that a carrier charged across all of its routes.[30] Notice that our definition of economic marginal cost of a seat is very helpful to clarify an apparent paradox of the role of bankruptcy filings in the airline industry. On one hand, while under bankruptcy protection an airline might be able to decrease the usual business overhead costs, such as costs associated with staff functions, general administration, brand marketing, and common-use property. On the other hand, the same airline might still be unable to lower its operating costs, which are associated with route-specific marginal costs, such as aircraft maintenance costs or fuel costs. Thus, a bankruptcy filing can be very successful at lowering the fixed overhead costs, but not the marginal cost of a seat. The failure of the airlines to lower their operating marginal cost is exactly what we show next.

First, we consider the traditional cost measure used in the airline industry, average cost per seat mile (CSM). The average cost to carry one passenger for one mile is known in the airline industry as the average cost per seat mile. It is constructed using the ratio of the quarterly operating expenses over the quarterly total of the product of the number of seats transported and of the number of miles flown by the airline. We gather data on operating expenses from the Air Carrier Financial Reports (Form 41 Financial Data) and on the total number of seats and miles flown from the Air Carrier Statistics (Form 41 Traffic). The mean of the average cost per seat mile is approximately 9 cents per seat mile, and can be as low as 4 cents and as high as 13 cents. This variable is not market specific. Panel I of Table 10 presents the mean CSM for each bankrupt carrier, across markets and year–quarter observations, for the periods before, during and after its bankruptcy (measured in US dollars). There is no evidence of persistent cost declines during or after a carrier's filing. In the case of United Airlines, the average CSM prior to the bankruptcy filing is 9.4 cents, marginally rising during bankruptcy to 9.8 cents, and continuing to rise after United's exit from bankruptcy, to 10.6 cents.[31] Similar results hold for USAir's first filing, where average CSM pre- and during bankruptcy was 12.1 cents, rising marginally to 12.5 cents post bankruptcy. For ATA, Delta, and Northwest we observe that the average CSM increases while the firms operate under bankruptcy. ATA and Northwest marginally lowered average CSM after exiting bankruptcy relative to the in-bankruptcy CSM, yet Delta continues to increase its CSM. It is only in the case of USAir's second filing that we observe a decline in average CSM: pre-bankruptcy this was 12.5 cents, dropping to 11.4 during bankruptcy, and continued to fall after USAir exited court protection. The unusual cost pattern observed to USAir's second filing can be explained by the carrier's exit strategy: USAir emerged after merging with low cost carrier America West.[32]

Following our discussion above, for each of the bankrupt carriers, we compute the lowest ticket fare across markets and year–quarters

Table 10
Accounting and economic cost before, during, and after the bankruptcy filing.

	Before bankruptcy	During bankruptcy	After bankruptcy
Panel I: accounting seat per mile costs before, during, and after the bankruptcy filing (means)			
The unit of measure is a dollar. Thus, 0.094 are 9.4 cents per seat per mile.			
United	0.094	0.098	0.106
	(0.008)	(0.007)	(0.002)
US Airways, First bkt	0.121	0.121	0.125
	(0.011)	(0.005)	(0.007)
US Airways, Second bkt	0.125	0.114	0.110
	(0.007)	(0.004)	(0.004)
ATA	0.068	0.091	0.074
	(0.011)	(0.040)	(0.004)
Delta	0.088	0.109	0.111
	(0.010)	(0.004)	(0.000)
Northwest	0.095	0.116	0.110
	(0.010)	(0.009)	(0.002)
Panel II: The economic opportunity cost: costs before, during, and after the bankruptcy filing			
These are lowest prices for a ticket that a carrier charges in a quarter-year. They are averaged across the markets, year, and quarters.			
United	50.560	53.594	55.563
	(3.403)	(3.026)	(3.881)
US Airways, first bkt	52.137	51.215	55.331
	(4.347)	(2.876)	(4.020)
US Airways, second bkt	53.0146	49.667	51.643
	(4.379)	(2.743)	(4.334)
ATA	68.507	57.523	61.393
	(11.358)	(4.623)	(11.039)
Delta	50.436	49.796	54.086
	(3.945)	(2.885)	(4.087)
Northwest	50.340	46.285	49.470
	(4.007)	(3.436)	(1.931)

[30] This notion of economic marginal cost seems to be already in Borenstein and Rose ["Competition and Price Dispersion in the US Airline Industry, Journal of Political Economy, 1994, vol. 102, no. 4, pages 664–665].

[31] Another way to look at this issue is to consider the numerator and denominator of the CSM separately. The numerator is given by the total operating costs. In the case of United, for example, the total operating costs were, on average, equal to $1,259,990,000 before the bankruptcy filings, and equal to $1,660,385,000 after the exit from bankruptcy. So the total operating costs increased by 30%. As for the denominator, the number of seat-miles before filing for bankruptcy protection was equal to 1.39e + 10 seat-miles and equal to 1.58e + 10 after the exit from bankruptcy. So the denominator increased by 13%. Overall the CSM for United increased.

[32] In Figures that are available from the authors, we report a time series of CSM for United Airlines and USAir for the period pre-, during, and post- bankruptcy. Consistent with the above findings, we do not observe any significant cost decline during or following the firm's bankruptcy filing. Evidence from the average CSM does not support the hypothesis that firms filing for bankruptcy protection can significantly reduce costs and thereby impact product market competition.

and summarize it in Panel II of Table 10. As with the evidence for average CSM, we do not find significant changes in the economic opportunity costs during or after the bankruptcy filing. Except for United Airlines' bankruptcy, all other bankrupt carriers temporarily lower economic costs during bankruptcy, only to increase it again once it emerges from bankruptcy. The pre-bankruptcy economic cost for USAir's first filing was 54.14 dollars, falling to 51.22 dollars during bankruptcy, and rising to 55.33 dollars after the carrier exited bankruptcy protection. For Delta, pre-bankruptcy economic cost was 50.44 dollars, barely falling to 49.80 dollars during bankruptcy, only to rise above its pre-bankruptcy cost to 54.09 dollars after exiting bankruptcy. In the cases of ATA and USAir second filing, the post-bankruptcy economic cost is above the in-bankruptcy cost, but still slightly below the pre-bankruptcy one; for instance, ATA's pre-bankruptcy cost was 68.51 dollars, falling to 49.67 dollars during bankruptcy, and rising to 51.64 post-bankruptcy (relative to the in-bankruptcy cost). These results on economic costs, pre-, during, and post-bankruptcy, do not support the hypothesis that firms operating under Chapter 11 significantly and permanently lower operating cost.

8. Conclusions

Our paper empirically examines whether a firm's bankruptcy filing affects product market competition, using evidence from the US airline industry. We find that bankruptcy filings lead to a reduction of capacity and prices in the industry. Together with the fact that we do not find any evidence of changes in the marginal cost of transporting a passenger, our results suggest that bankruptcy filings are effective at reducing fixed costs but not marginal costs.

To our knowledge, there is no simple theoretical connection between bankruptcy filings and market competition. Nonetheless, our results are consistent with the idea, often repeated in the mass media, that bankruptcy filings are the result of wars of attrition over capacity and network cutbacks. Since capacity cutbacks are a public good that must be provided privately, each firm waits for its competitors to cut capacity first.[33] Unless the industry outlook improves, the firm generating the lowest cash flows and with the weakest financial position becomes unable to meet its debt obligations, ultimately having to seek bankruptcy protection. Firms engage in such a war of attrition when Chapter 11 of the US Bankruptcy Code is an option, since this law protects the insolvent firm from liquidation by creditors, and allows the firm to void contracts and reorganize its business strategy, effectively granting the firm a second chance at life. Operating under Chapter 11, the insolvent firm reduces capacity and downsizes its network, which can lead to higher product-market prices. This is the channel through which we link bankruptcy filings to product market price, capacity, and network effects.

Our analysis is restrictive in a number of aspects and suggests numerous extensions, which constitute themes for future research. First, our paper focuses on the effect of bankruptcy filings on product market competition, but it would be equally interesting to investigate the determinants of bankruptcy filings. That new research might look in more detail into the role of the entry and expansion of low cost carriers. On the one hand, it is doubtful that it was the advent of low cost carriers per se that led to bankruptcy filings since bankruptcies were pervasive at the beginning of the 1990s, before the surge in the number of LCCs. On the other hand, the expansion of low cost carriers in the contemporary US airline industry might have accelerated the number and frequency of bankruptcy filings as well as their duration.

Second, another important feature of a bankruptcy filing is the shift of control from equity to debt holders. We do not incorporate such a change in our paper, as we assume that the objective of the firm is to maximize profits, regardless of the ownership structure. Future research might look into the bargaining between different agents. Eraslan (2008) and Eraslan and Yilmaz (2008) have made important contributions on this while looking at personal bankruptcies.

Finally, our paper uncovers stylized empirical patterns and suggests a unifying explanation. An interesting and challenging line of research would be to estimate a structural dynamic model of competition that incorporates the possibility of wars of attritions among airline firms along with the possibility to file for bankruptcy protection. An important contribution in this direction has been made by Takahashi (2010), who estimates the impact of competition and exogenous demand decline on the exit process of movie theaters in the US from 1950 to 1965. Takahashi shows that theaters that are making negative profits may choose to remain in the market if they expect to outlast their competitors, because at that point their profits would increase. Takahashi shows that this creates a significant delay in the exit process.

[33] See Ghemawat and Nalebuff (1990).

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