Bankruptcy protection and pricing strategies in the US airline industry

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Abstract

In this paper, we empirically examine the effects of bankruptcy protection (Chapter 11) on an airline and its rivals’ pricing strategies. We estimate a price equation on a panel of 400 routes over the period 1987–1993. We also examine the impact of bankruptcy on a firm’s average operating costs. The results indicate that a bankrupt airline is able to lower its operating costs and that these cost reductions are partially translated into lower prices. Rivals appear to lower their prices more than the bankrupt carrier. Their reaction appears stronger in dense markets and in markets where they face a bankrupt airline that will not survive its bankruptcy. They also appear to start lowering their prices prior to the bankruptcy of the weak airline. These results are consistent with aggressive pricing by rivals and the magnitude of the estimated effects suggest that they may have contributed, in part, to the financial losses of the industry in the early nineties. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Airline pricing; Bankruptcy

1. Introduction

The role of bankruptcy protection (Chapter 11) in influencing the performance of the US airline industry as a whole created some controversy in the early nineties. The National Commission, to ensure a strong and healthy airline industry, set up by President Clinton in 1992, identified bankruptcy laws as one of the main sources of the airline industry’s financial difficulties. The Commission proposed reforming the bankruptcy procedures and, particularly, restricting the

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length of time a company may remain operating under the protection of Chapter 11. Yet, until very recently, relatively little empirical evidence has been presented on the link that may exist between bankruptcy protection and firms’ competitive behavior.¹ In this paper, we attempt to fill this gap by providing some empirical evidence on the link among bankruptcy, costs and pricing in the US airline industry.

Bankruptcy laws are normally designed to protect firms experiencing short term financial difficulties that can be overcome by restructuring. However, if bankruptcy procedures are used to maintain companies unfit for survival, this could seriously disturb the competitive process and prevent the transition of an industry to a long term equilibrium. At the end of the eighties and during the early nineties, the airline industry experienced several major bankruptcies, starting with Eastern Airlines and Braniff, followed by Continental, Pan Am, Midways, American West and TWA. Over the same period, the industry, as a whole, experienced poor financial results. Airlines lost US$4 billion in 1990, $2 billion in 1991, close to 5 billion in 1992 and 2 billion in 1993. Is the continued operation of bankrupt firms simply a consequence of these poor financial results, or one of the causes? There are several hypotheses supporting the idea that airlines under Chapter 11 protection could be responsible, in part, for these poor results. For example, one can argue that a bankrupt firm may be more likely to pursue myopic pricing strategies as it faces possible liquidation in the near future. Another hypothesis is that Chapter 11 airlines are able to cut costs in ways non-bankrupt firms cannot. For example, after going bankrupt, Continental was able to renegotiate its aircraft lease payments.² Non-bankrupt rivals may have to match the low fares initiated by bankrupt carriers without enjoying similar cost savings. Other arguments have been proposed linking bankruptcy with poor financial results. We review them in Section 2. In Section 3, we estimate a fixed-effects price equation on a panel of 400 US domestic city-pairs for the 1987–1993 period. Our price equation includes the bankruptcy status of the firm and its rivals on the route. The results are presented in Section 4. In Section 5, we provide some results suggesting that there exists a link between bankruptcy and costs. We conclude in Section 6.

The main results of this paper indicate that a Chapter 11 airline slightly lowers its prices after declaring bankruptcy (−2.3%). This price cut appears to be driven by a cost reduction of about 4.2%. Non-bankrupt rivals react to the presence of a Chapter 11 airline by lowering their price by approximately 4.35%. This means that rivals cut their prices by more than the Chapter 11 airline. The rivals’ reaction also appears to be stronger in dense markets and in markets where the Chapter 11 airline is a firm that will not survive beyond its bankruptcy phase. These results are consistent with some form of aggressive pricing; an interpretation that is further supported by the fact that rivals of a Chapter 11 airline start lowering their prices (by about 1.02%) before the troubled airline declares bankruptcy. The magnitude of these effects suggests that the behavior of Chapter 11 airlines and their rivals may have contributed, at least in part, to the poor financial results of the industry during the period examined.

¹ One exception is Borenstein and Rose (1995).
² Business Week, March 18, 1991, p. 35.
2. Bankruptcy and pricing

There have been two waves of bankruptcies in the airline industry. The first occurred in the early eighties and the second at the beginning of the nineties. Our data cover the second wave. Table 1 describes the bankruptcies in our sample. The time spent in Chapter 11 varies greatly from airline to airline. Braniff Airways was under Chapter 11 protection for one month until it was liquidated. Continental Airlines filed for Chapter 11 in December 1990 and emerged from bankruptcy protection two and half years later. America West Airlines was operating under Chapter 11 protection from June 1991 and emerged after the period covered by this study. In general, an airline under bankruptcy protection faces problems if it tries to prolong Chapter 11 proceedings. Legal fees accumulate with time spent in Chapter 11, and creditors (with the court’s permission) can take control of the firm to either operate or liquidate it.

In the early nineties, the airline industry was characterized by major financial difficulties with financial losses in excess of $10 billion over the 1990–1993 period. It is not surprising then, that some have argued that there exists a link between bankruptcy protection and the industry’s financial difficulties. The National Commission to Ensure a Strong Competitive Airline Industry (1993) noted in its report that “The issue of bankruptcy has received more attention than almost all others in the course of the Commission’s work”. Different arguments have been put forward in the debate linking bankruptcy protection to the financial turmoil of the industry. Some have argued that Chapter 11 affects the cost and competitive behavior of the financially troubled airlines while others contend that it is the conduct of a weak airlines’ rivals that is affected. We review some of these arguments below.

First, it has been argued that Chapter 11 protection makes it possible for firms to reduce their costs. A firm operating in Chapter 11 is allowed to postpone all repayments of capital and interest until reorganization has been completed. It can also reject any contract it deems not in its best interests, particularly collective bargaining agreements. These provisions give the Chapter 11 firm the flexibility and bargaining power to renegotiate contracts which could lead to cost reductions and fare cuts that must eventually be matched by rivals. In the airline industry, there are several examples of contract renegotiation in the wake of bankruptcy protection. For example, TWA’s labor union agreed to renounce $660 million in wage and benefit concessions in exchange for 45% of the airline. Continental Airlines successfully renegotiated its payments schedule on leased aircraft while American West renegotiated leases with all of its hardware and software vendors, cutting its operating costs 25% to 50%. These examples tend to support the argument that Chapter 11 helps firms cut costs by means of contracts renegotiation. However, it is important to note that such renegotiations could also be undertaken by airlines that are not operating under bankruptcy protection. Furthermore, a financially distressed airline may also be in a

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3 This is called ‘automatic stay’ (Bankruptcy Code section 362 a,b). For a detailed description of the bankruptcy procedure see Franks et al. (1989) and Bienenstock and Martin (1987).
4 Bankruptcy Code Section 1113.
good bargaining position to obtain concessions from suppliers or labor, even if it is not under Chapter 11 protection (see Perotti and Spier, 1993).  

Second, it has been argued that financially troubled airlines, especially those under the protection of Chapter 11 are more likely to adopt short term profit maximization behaviors in an effort to raise cash. The idea is that airlines facing a higher risk of liquidation will discount future profits more heavily, in an effort to maximize short term profits. Theoretically, the pricing implications of such myopic behavior may be different depending on the nature of the competitive environment. Long term profit maximization may lead firms to charge higher prices than those associated with short term profit maximization. In oligopoly models with repeated interactions for example, tacit collusion may be sustained by the threat of future punishment in retaliation against present deviation (see Friedman, 1977). In such a setting, a financially weak airline with high discount rate may be more tempted to deviate, thereby leading to a breakdown of collusion. Such an effect may have serious financial consequences in the airline industry given its cost structure. Indeed, in the short term, when capacity is fixed (flight frequency, type of aircraft used), airlines face high fixed cost (capacity cost) and low short term marginal cost (the cost of an extra passenger). If demand is unexpectedly low, short term profit maximization may lead to prices that are well below long run marginal costs, resulting in financial losses.

However, dynamic considerations could also lead healthy firms to charge prices that are lower than those which result from short term profit maximization, as a form of investment in future market shares. This may be the case, for example, when consumers that have bought once from a particular firm incur costs if they decide to switch supplier for subsequent purchases. For example, frequent-flyer programs, by rewarding repeat-purchase, creates switching costs in the airline industry. In this context, it may be optimal for a firm to charge low prices today in order to gain the loyalty of new consumers (see Klemperer, 1987). A Chapter 11 firm may decide to reduce such an investment in future market shares and, therefore, may end up increasing its prices as a result of its financial weakness.

Theoretically, the competitive behavior of a Chapter 11 airline may be influenced by other factors. The analysis of Brander and Lewis (1986) show that a leveraged firm may act more

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7 Note however that, in a world of asymmetric information, declaring bankruptcy, could represent a credible signal that the firm is indeed experiencing financial trouble.

8 See, for example Aviation Week & Space technology, May 3, 1993, p. 66.
aggressively on the product market as a result of what they call the limited liability effect. This effect results from the fact that equity holders (who are assumed to control the firm) are the residual claimants only in good states of the world (e.g., good demand). In bad states of the world (i.e., when the firm cannot meet its financial obligations), bondholders become residual claimants. Brander and Lewis demonstrate that the limited liability of equity holders may lead them to choose a more aggressive strategy in the product market. To the extent that this distortion increases with debt level and given the fact that Chapter 11 firms are likely to be plagued by large debts, we would expect Chapter 11 firms to be more aggressive in the output market.  

Third, it is generally recognized that an airline operating under Chapter 11 protection may face a decline in demand as a result of its status. Consumers may fear flying on an airline facing possible liquidation. Frequent Flyer Programs and Travel Agent Commission Override systems may reinforce this shift as a frequent traveler or a travel agent may lose any accumulated bonus if the airline is liquidated. This could force the Chapter 11 airline to slash fares in an effort to retain their consumers.

It is also possible that the presence of a financially weak airline and especially a Chapter 11 firm, affects the competitive strategy of its rivals. Some industry analysts have argued that it is healthy competitors that have engaged in aggressive pricing. Theoretically, asymmetric information or imperfect financial markets may justify predation in this context (see for example Benoit, 1984; Bolton and Scharfstein, 1990). 

Before proceeding to the empirical analysis, it is important to point out that even if we find a statistical link between a firm’s bankruptcy status and its prices or the prices of its rivals, this link does not necessarily imply that Chapter 11 causes these low prices. First, most of the arguments that have been reviewed above are not only valid for Chapter 11 firms but more generally for financially distressed companies. The bankruptcy status of a firm may therefore just be a proxy for financial distress. Second, it is possible that the causal link between prices and bankruptcy is reversed. Chapter 11 airlines would be companies that have been operating in low price, low margin markets. It is these low prices that would cause bankruptcy and not the reverse. The relevance of these alternative will be examined in our empirical analysis.

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9 Brander and Lewis assume that firms compete in quantities. In this context, more aggressive behaviors mean that total output is larger than when there is no limited liability effect. Note however, that if bondholders take control of the Chapter 11 firm, the opposite effect may occur since decisions are then taken by the residual claimants in bad states of the world. The limited liability of equity holders may also make collusion more difficult to sustain (see Maksimovic, 1988). Also note that it has been shown that high debts may serve as a credible commitment to low investments in the future and therefore could actually ease competition (see Phillips, 1995).

10 Theoretically, asymmetric information or imperfect financial markets may justify predation in this context (see for example Benoit, 1984; Bolton and Scharfstein, 1990).

11 For a theoretical analysis see Saloner (1987).

12 There is empirical evidence, in other industries, indicating that a firm’s leverage affects its pricing decisions (see Chevalier, 1995; Chevalier and Scharfstein, 1995).
3. Empirical evaluation

Since the deregulation of the industry in the late seventies, numerous empirical studies of airline pricing have been conducted. Most of these studies (for example Bailey et al., 1985; Borenstein, 1989; Evans and Kessides, 1993) have estimated a price equation at the route level such as.\(^\text{13}\)

\[ P = F(C, D, S) \]

A measure of pricing \( P \), such as the average price, is explained by variables that reflect the cost \( (C) \), demand \( (D) \) and market structure \( (S) \) conditions. This is the approach we adopt here to examine the role of bankruptcy protection on pricing.

3.1. The data and sample

The main source of the data is the US Department of Transportation’s Origin and Destination Survey Data Bank 1A (O&D-DB1A). This survey contains quarterly information on price, carrier, origin, destination, class for all segments and distances for a 10% random sample of tickets used on all flights by US carriers. Here, we analyze the data for the second quarter of each year from 1987 to 1993. The O&D data contain over a million records corresponding to more than 11,000 routes. Some records, such as non-credible fares, first class and business class fares were eliminated (see Appendix A for details). The bankruptcy dates and status of the airlines are taken from the Bankruptcy Yearbook and Almanac (New Generation Research, 1993). Additional information on the status of the airlines was collected from Air Transport World and the Wall Street Journal.\(^\text{14}\)

Cost information was obtained from The Air Carrier Financial Statistics Quarterly and the Air Carrier Traffic Statistics Monthly (US Department of Transportation, Cambridge, MA).

A unit of observation is defined at the route-firm-time level. Following notably Evans and Kessides (1993), we define a route as a city-pair implying that we aggregate the traffic of airports serving the same city. Certain rules were applied to eliminate non-comparable markets: the two endpoint cities are restricted in the continental US and markets with a distance of less than 150 miles are eliminated as they face competition from other means of transport. Among the remaining routes, we selected the 400 most heavily traveled city-pairs.\(^\text{15}\) We prefer to restrict our sample to dense markets as small routes may have a very different competitive structure. For example, thin markets are more likely to be served by commuter airlines or non-jet aircraft. Lastly, it should be noted that we eliminate observations for airlines on a route with a market share of less than 3%.\(^\text{16}\)

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\(^{13}\) A few studies (see for example Berry, 1990 or Brander and Zhang, 1990) have adopted a structural approach. This approach has advantages but also limitations. For example, given the difficulties of identifying the parameters in this setting, they have to impose strong assumptions on costs, demand structure and on the type of competitive behavior.


\(^{15}\) The 400 largest markets were selected based on the number of passengers in 1986.

\(^{16}\) This is justified by the fact that an airline may appear on a route with a few passengers even if it does not serve this route on a regular basis (for example in case of rerouting due to bad weather conditions).
3.2. The empirical specification

We estimate the following equation:

\[ \log(P_{ir}) = \alpha_i + \alpha_r + \alpha_t \text{BANK}_{it} + \alpha_2 \text{MBANK}_{rt} + \alpha_3 \log(\text{COST}_{it}) \]
\[ + \alpha_4 \log(\text{LOW-COST}_{ir}) + X_{irt} \beta + \theta_{irt}, \]

where \( P_{ir} \) is the weighted average of one-way fares on restricted and unrestricted coach service for airline \( i \) on route \( r \) at time \( t \). For example, one observation will be the average price charged by United Airlines in the second quarter of 1988 on the Chicago–Dallas route. A round trip is counted as two one-way flights.\(^{17}\) The average is taken over all itineraries and price categories for the airline over the quarter. More specifically, \( P_{ir} = \sum_k w_{ir} P_{irk} \) where \( P_{irk} \) is the price level \( k \) while \( w_{irk} \) is the number of passengers paying that particular fare.\(^{18}\) The average price therefore depends on two aspects, the airline’s fare structure and the passenger mix. While clearly the first aspect is part of an airline pricing policy, it is important to note that the second aspect is also determined by an airline competitive strategy. Indeed, a passenger choice of fare category depends not only upon her preferences (restrictions attached to different fare categories create some product heterogeneity) but also on the availability of seats in the various categories (i.e. the allocation by the airline of seats among the different categories). In this respect, an increase in the availability of low-fare seats may represent a competitive move by an airline. In fact, a firm could initiate a “price war” without changing its fare structure (\( P_{irk} \)), simply by increasing its supply of low-fare seats. The variable \( P_{ir} \) allows us to capture such a competitive move.\(^{19}\) \( \alpha_i, \alpha_r, \alpha_t \) are fixed firm, route and time effects. These control for all the unobservables at these levels. For example, \( \alpha_i \) may control for factors such as carrier reputation, fleet structure (assuming these aspects are relatively stable over time), \( \alpha_r \) controls for route distance, type of travelers (business or leisure oriented routes) and \( \alpha_t \) controls for variation in factor price (common to all airlines) or macro economic conditions. BANK\(_i\) is a dummy variable taking the value 1 if airline \( i \) is bankrupt at time \( t \) and 0 otherwise. MBANK\(_r\) is a dummy variable taking the value 1 if one of the airlines operating on route \( r \) at time \( t \) is bankrupt. Note that this variable is also set to 1 if the observation corresponds to a Chapter 11 airline. COST\(_i\) is the average operating cost per-passenger-mile for airline \( i \) at time \( t \) (cost information at the route level is not available).\(^{20}\) LOW-COST\(_{ir}\) is the lowest operating cost per-passenger-mile among rivals of firm \( i \) on route \( r \) at time \( t \). \( X_{irt} \) are the other explanatory variables. They include:

\(^{17}\) A round-trip fare is divided by two in order to obtain the two corresponding one way fares.

\(^{18}\) Note that over a quarter, there may be different price levels \( k \) for the same fare class (e.g. restricted and unrestricted coach) reflecting the continual adjustment of prices in a yield management setting.

\(^{19}\) Note that one limitation that has to be taken into account when interpreting the results is that, given the limitations of the data, we are unable to control for all the factors that may affect the demand conditions for the different fare categories. This may affect our results if these factors are correlated with the variables that are included in our analysis (i.e. the standard missing variable bias). However, the inclusion of fixed-effects at the route, time and market levels should minimize this problem.

\(^{20}\) Note that the results would be identical if we were multiplying the variable COST by the route distance in order to obtain a measure at the route level. Indeed, the effect of the route distance is already captured by the fixed route effects.
CIRC$_{rt}$ – the average circuity of the flights offered by airline $i$ on route $r$ at time $t$. Circuity is the ratio of the distance flown to the direct distance between the two endpoints.

MSR$_{rt}$ – airline $i$ market share of passengers on route $r$ at time $t$.

HERF$_{rt}$ – the level of concentration of route $r$ at time $t$ measured by the Herfindahl index. This index is defined as the sum of the squared market shares. A Herfindahl index close to one indicates that the route is very concentrated.

N-DEST$_{irt}$ – the sum of the number of destinations offered by airline $i$ at each endpoint cities defining route $r$ at time $t$.

ORIG-MS$_{irt}$ – the weighted average of the airline market share of originating passengers at the two endpoint airports (the weight is the percentage of the airline passengers on the route that originate at each endpoint). For each endpoint airport, the airline market share of originating passengers is the ratio of the number of the airline passengers originating from the airport (whatever their destination), divided by the total number of passengers originating from the airport.

ORIG-HERF$_{rt}$: – weighted average, across the two endpoints defining route $r$, of the endpoint degree of concentration. The concentration at one endpoint is measured by the Herfindahl index of passengers originating at that endpoint (whatever their destination). The weight for one endpoint is the percentage of passengers on the route that originate from that endpoint.

$\theta_{it}$ – the error term.

Given this specification, the direct effect of bankruptcy is captured by BANK and MBANK. Indeed, if firm $i$ is bankrupt, the impact of its status on the price it charges on route $r$ at time $t$ will be captured by $\alpha_1 + \alpha_2$. If firm $i$ is not bankrupt, but one of its competitors on the route is, the effect of the presence of this Chapter 11 carrier on firm $i$’s price will be measured by $\alpha_2$. This specification allows us to directly test whether the pricing strategy of a Chapter 11 airline is different than the strategy of its rivals. If there is a difference, the coefficient $\alpha_1$ will be significant. 21

As we have mentioned in Section 2, the impact of bankruptcy may also be indirect. The bankrupt carrier may be able to reduce its costs and then charge lower prices. This indirect effect will not be captured by $\alpha_1$ as we are holding the cost constant (through the variables COST and LOW-COST). To capture this indirect effect, we also estimate the price equation while excluding the cost variables (COST and LOW-COST). In this case, the variable BANK should capture both the direct and indirect effect.

The other explanatory variables have all been identified in other studies as affecting pricing. The variable CIRC is introduced as it may affect both cost and demand conditions. MSR and HERF control for the competitive structure of the route. Airport dominance has been shown to be a source of market power and product differentiation in the industry (for example, Borenstein, 1989). To capture these effects, we include ORIG-MS, N-DEST and ORIG-HERF. 22 The

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21 The sample correlation between BANK and MBANK is 0.45. Note that the results are similar if we use a specification where BANK = 1 if the airline is bankrupt and zero otherwise while MBANK is 1 if a rival is bankrupt and zero otherwise.

22 For a detailed description of the potential effects of these variables, see Borenstein (1989).
mean and standard deviation of the different variables for the sample are presented in Appendix A.

4. Estimations and results

We choose a log–log functional form. However, we introduce some explanatory variables directly (MSR, HERF, ORIG-MS and ORIG-H) in the price equation to allow their elasticity to vary. The specific effects ($x_r$, $x_t$, $x_i$) are treated as fixed effects to allow for the correlations between the unobservable and observable variables (see, Baltagi, 1995). We maintain the hypothesis that the explanatory variables and, particularly BANK, can be treated as exogenous in the sense of being pre-determined. This may be justified by the fact that the bankruptcy status of a firm is the result of past decisions rather than present pricing strategies. At any rate, finding good instruments in this context is a problem and there is mounting evidence which suggests that using weak instruments may lead to serious problems of inference (see Staiger and Stock, 1997).

The coefficient estimates for the price equation are presented in Table 2. The results (model 1) indicate that an airline under the protection of Chapter 11 does not significantly alter its pricing policy. Indeed, the sum of the coefficient estimate on BANK and MBANK is not significantly different from zero. The rivals of a bankrupt firm, however, significantly lower their average price by about 4.32% as a result of the presence of the bankrupt competitor. In model 2, we exclude the variable COST and LOW-COST so that BANK can capture both the direct and indirect (through cost) effects on prices. The estimated coefficients suggest that, indeed there is an indirect effect of bankruptcy on prices through costs Table 3. In fact, it appears that the bankrupt carrier lowers its prices by about 2.34%. However, this is still smaller than the price cut by the non-bankrupt rivals on the route that appear to decrease their prices by almost 5%. The difference in the prices of the bankrupt carrier and its rivals is statistically significant as the coefficient on BANK is significant. Such a difference could indicate some form of aggressive strategies by rivals in order to force the liquidation or exit of the weak competitor. Yet clearly, other interpretations are possible and such a difference may simply reflect a change in passenger mix that does not result from an aggressive move by rivals.

The control variables have an effect that is consistent with what has been found in other studies. Higher costs mean higher prices but the elasticity is less than one. A large share of traffic on the route allows an airline to charge higher prices and more concentrated routes have higher prices on average. Airport dominance, measured by market share of traffic at endpoints and by the number

$^{23}$ Note that the results are robust to changes in the functional form.

$^{24}$ F-value of 0.0419 with (1, 10,035) degrees of freedom.

$^{25}$ For example, as noted by a referee, the Chapter 11 firm may cut its full fare coach leading to a decline in the rivals demand for that fare category. Rather than cutting their prices on that fare category, rivals may simply react to the lower demand by reallocating their capacities onto the low-fare categories. The rivals average price may therefore be lower than the Chapter 11 average price. However, note that if the cross-product elasticities among different fare categories are high, such a change in capacity allocation by rivals could also represent a competitive threat aimed at hurting the weak airline.
of destinations offered, also allows an airline to charge higher prices. On the other hand, an increase in the level of concentration at the airport level lowers the average price. 26 These results are consistent, notably, with Borenstein (1989).

Table 2
Price equation results (dependent variable log($P_{it}$))

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BANK</td>
<td>0.0459*</td>
<td>0.0255*</td>
</tr>
<tr>
<td></td>
<td>(0.0077)</td>
<td>(0.0077)</td>
</tr>
<tr>
<td>MBANK</td>
<td>-0.04424*</td>
<td>-0.0492*</td>
</tr>
<tr>
<td></td>
<td>(0.00582)</td>
<td>(0.0058)</td>
</tr>
<tr>
<td>log(COST)</td>
<td>0.4635*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.02941)</td>
<td>-</td>
</tr>
<tr>
<td>log(LOW-COST)</td>
<td>0.06263*</td>
<td>-0.0842*</td>
</tr>
<tr>
<td></td>
<td>(0.0228)</td>
<td>(0.0216)</td>
</tr>
<tr>
<td>log(CIRC)</td>
<td>-0.0809*</td>
<td>-0.0842*</td>
</tr>
<tr>
<td></td>
<td>(0.0213)</td>
<td>(0.0216)</td>
</tr>
<tr>
<td>MSR</td>
<td>0.1066*</td>
<td>0.1111*</td>
</tr>
<tr>
<td></td>
<td>(0.0124)</td>
<td>(0.0126)</td>
</tr>
<tr>
<td>HERF</td>
<td>0.2356*</td>
<td>0.2432*</td>
</tr>
<tr>
<td></td>
<td>(0.0253)</td>
<td>(0.0253)</td>
</tr>
<tr>
<td>log(N-DEST)</td>
<td>0.0610*</td>
<td>0.0524*</td>
</tr>
<tr>
<td></td>
<td>(0.0077)</td>
<td>(0.0078)</td>
</tr>
<tr>
<td>ORIG-MS</td>
<td>0.0046*</td>
<td>0.0045*</td>
</tr>
<tr>
<td></td>
<td>(0.0002)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>ORIG-HERF</td>
<td>-0.0031*</td>
<td>-0.0044*</td>
</tr>
<tr>
<td></td>
<td>(0.0006)</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.8417</td>
<td>0.8371</td>
</tr>
<tr>
<td>Number of obs.</td>
<td>10,477</td>
<td>10,477</td>
</tr>
</tbody>
</table>

* Significant at 0.01%.

Table 3
Impact of bankruptcy protection on average prices

<table>
<thead>
<tr>
<th></th>
<th>Effect on price model 1</th>
<th>Effect on price model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airlines under Chapter 11 protection (1)</td>
<td>+0.16%</td>
<td>-2.34%*</td>
</tr>
<tr>
<td>Rivals of airlines under Chapter 11 protection (2)</td>
<td>-4.32%*</td>
<td>-4.80%*</td>
</tr>
</tbody>
</table>

* Significant at 0.01%. The estimated effects are obtained using the following formulas: (1) effect = $\exp[\log(100)+a_1+a_2] - 100$; (2) effect = $\exp[\log(100)+a_2] - 100$.

This could be explained by the fact that as we control for ORIG-MS, an increase in ORIG-HERF means that the firm has to compete against larger competitors at the endpoint airports. This probably reduces its advantage in terms of product differentiation.

26 This could be explained by the fact that as we control for ORIG-MS, an increase in ORIG-HERF means that the firm has to compete against larger competitors at the endpoint airports. This probably reduces its advantage in terms of product differentiation.
months after Chapter 11 is declared). They find that if the Chapter 11 bankrupt carrier lower its average price by about 5% over that time period, rivals of this firm would actually increase their prices slightly (+1.1%). In fact, their results suggest that rivals cut their prices six months prior to bankruptcy and then increase them in subsequent quarters leading to a net increase over the one-year period. There are differences at two levels between their work and ours. First, the structure of the data and samples are different. BR use data for every quarter from 1988 to 1992 for a sample of 1777 city-pairs. These city-pairs correspond to all domestic markets for which there are at least 300 observed passengers during each quarter. 27 Our sample include 400 routes for which there are at least 750 observed passengers for the second quarter of the years 1987–1993. Moreover, BR eliminate observations for airlines on a route that have a market share smaller than 10% while we only eliminate airlines with a market share smaller than 3%. Second, the empirical specifications are different. BR regress the quarter-to-quarter change in log average price for an airline on a route as a function of the lagged change in the log price for the airline-route, the route Herfindahl index and its one period lagged value, fixed time effects and indicators for the bankruptcy status of the firms and its rivals.

It appears that neither the difference in the control variables nor the difference in the criteria used to exclude small airlines help explain the difference in the results. 28 An interesting potential explanation for the difference between BR’s results and ours is that rivals of a Chapter 11 airline react more aggressively in larger markets. Since BR’s sample includes a large number of smaller routes, this would explain the difference in the results. To determine whether the rivals reaction depends on market size, we test whether the coefficients on BANK and MBANK are different in the denser routes of our sample. We define a dummy variable SIZE as equal to 1 if the number of observed travelers is greater than 5096 over the quarter. 29 We introduce the interaction terms BANK × SIZE and MBANK × SIZE in the price equation. 30 The results, reported in Tables 4 and 5, clearly indicate that the rivals’ price cut is significantly larger in dense markets. The difference in the sample structure is therefore likely to explain the differences in the results between BR analysis and ours. 31

27 Recall that the O&D data are a 10% sample of all tickets used on US carriers.
28 We tested whether eliminating the control variables from our specification that are excluded in BR, affected the results (these variables are: COST, LOW-COST, CIRC, MSR, N-DEST, ORIG-MS, ORIG-HERF) and found that the estimated coefficient on MBANK was very close to the estimated value obtained using our initial specification. We tested the impact of eliminating observation for airlines that have a market share less than 10%. Again, we found little change in the coefficient of MBANK. Note that BR’s results, on the other hand, appear sensitive to the elimination of small airlines. Indeed, in an earlier version of their paper, BR indicate that when they include observations for airlines on a route with at least 5% of market share, they find that the Chapter 11 firm increases its price by 5.8%, while rivals lower their price by 0.6%.
29 This figure corresponds to the median value of passengers in the sample in 1993.
30 The cost variables are not included in the regression so that BANK captures both the direct and indirect effects.
31 Another factor that may explain the difference between BR’s results and ours is the dynamics of BR’s specification. While we cannot test that possibility given the structure of our data, let us simply note here that such a specification raises specific issues such as the choice of the lag length, the possibility that rivals react after the six-month time period considered by BR or the possibility that the rivals’ reaction depends on the composition of the demand (leisure–business) and, therefore, depends upon the season considered. Finally, note that Ross (1997) presents evidence suggesting that price wars (identified by a significant increase in the percentage of discount fares) are more likely on routes where a Chapter 11 airline is present.
So far, our results could indicate some form of aggressive pricing by rivals. To further examine this possibility, we test whether there is a link between the fate of the Chapter 11 airline and its rivals pricing strategies. We define a dummy variable FAIL as equal to 1 if airline \( i \) is bankrupt at time \( t \) and it will not survive its bankruptcy (i.e., the company will be liquidated) and 0 otherwise. \(^{32}\) We also define MFAIL as 1 if the route includes a Chapter 11 airline that will be liquidated and zero otherwise. We estimate the price equation with the interaction terms BANK \( \times \) FAIL and MBANK \( \times \) MFAIL. The estimated coefficients are reproduced in Table 6 and the estimate impacts are shown in Table 7. \(^{33}\) It appears there is a link between the size of the rivals price cut and the fate of the Chapter 11 firm. We find that when the Chapter 11 airline survives its bankruptcy phase, the rivals price cut is about 1.4% while when the Chapter 11 airline

### Table 4

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimated coefficient (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BANK</td>
<td>0.0111 (0.0103)</td>
</tr>
<tr>
<td>MBANK</td>
<td>-0.0387* (0.0073)</td>
</tr>
<tr>
<td>BANK ( \times ) SIZE</td>
<td>0.02698*** (0.0129)</td>
</tr>
<tr>
<td>MBANK ( \times ) SIZE</td>
<td>-0.0198** (0.0085)</td>
</tr>
</tbody>
</table>

* Significant at 0.01%.
** Significant at 0.05%.
*** Significant at 0.1%.

### Table 5

<table>
<thead>
<tr>
<th>Impact of the bankruptcy by market size</th>
<th>Estimated effect on price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 11 airline in small markets (1)</td>
<td>-2.73%***</td>
</tr>
<tr>
<td>Rivals of Chapter 11 airline in small markets (2)</td>
<td>-3.79%*</td>
</tr>
<tr>
<td>Chapter 11 airline in dense markets (3)</td>
<td>-2.02%***</td>
</tr>
<tr>
<td>Rivals of Chapter 11 airline in dense markets (4)</td>
<td>-5.68%*</td>
</tr>
</tbody>
</table>

* Significant at 0.01%.
*** Significant at 0.1%.

The estimated effects were obtained using the following formulas: (1) effect = \( \exp[\log(100) + (0.0111 - 0.0387)] - 100 \); (2) effect = \( \exp[\log(100) - 0.0387] - 100 \); (3) effect = \( \exp[\log(100) + (0.0111 + 0.026 - 0.0387 - 0.0198)] - 100 \); (4) effect = \( \exp[\log(100) + (-0.0387 - 0.0198)] - 100 \).

So far, our results could indicate some form of aggressive pricing by rivals. To further examine this possibility, we test whether there is a link between the fate of the Chapter 11 airline and its rivals pricing strategies. We define a dummy variable FAIL as equal to 1 if airline \( i \) is bankrupt at time \( t \) and it will not survive its bankruptcy (i.e., the company will be liquidated) and 0 otherwise. \(^{32}\) We also define MFAIL as 1 if the route includes a Chapter 11 airline that will be liquidated and zero otherwise. We estimate the price equation with the interaction terms BANK \( \times \) FAIL and MBANK \( \times \) MFAIL. The estimated coefficients are reproduced in Table 6 and the estimate impacts are shown in Table 7. \(^{33}\) It appears there is a link between the size of the rivals price cut and the fate of the Chapter 11 firm. We find that when the Chapter 11 airline survives its bankruptcy phase, the rivals price cut is about 1.4% while when the Chapter 11 airline

---

\(^{32}\) This is the case for Eastern, Braniff, Pan Am and Midway.

\(^{33}\) The cost variables are not included in the regression. Thus, the bankruptcy variable captures both the direct and indirect effects. The coefficient estimates for the control variables are not reproduced as they are close to those obtained with the initial specification.
does not survive its bankruptcy protection, the rivals price cut is more than 7%. The rivals reaction could therefore play a role in explaining the fate of a weak airline.

As we mentioned in Section 2, a statistical link between the bankruptcy status of a firm and its prices or its rivals prices, does not necessarily imply that Chapter 11 protection causes these price changes. Chapter 11 protection may only be a proxy for the financial distress which would be the real source of the price changes. Another possibility is that the causality between price and bankruptcy is reversed. Airlines that fall into bankruptcy were operating in low price (low margin) markets. To examine the relevance of these other possible explanations, we introduce a lead on the variables BANK and MBANK to our pricing equation. That is, PRE-BANK is a dummy variable equal to 1 if airline \(i\) is going to fall under the protection of Chapter 11 within 12 months or is already operating under bankruptcy protection and 0 otherwise. The variable PRE-MBANK is 1 if one of the competitors on the route is, or will fall under bankrupt protection within 12 months. The idea is that airlines close to declaring bankruptcy are financially weak and if financial distress is causing low prices, we should find that the lead variables have a significant impact on prices. Similarly, if airlines under the protection of Chapter 11 were operating mostly in low price markets this should be picked up by our lead variables. The results are reproduced in Tables 8 and 9. 34 It appears that a financially stressed airline (within 12 months of being declared bankrupt)

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34 Once again, we use the specification that does not include the cost variables.
does not change its prices as the sum of the coefficient on PRE-BANK and PRE-MBANK is not statistically different from zero. However, rivals of financially distressed carriers charge slightly lower prices (−1.02%). After bankruptcy, the Chapter 11 firm lowers its prices by 2.3% (sum of the coefficient on PRE-BANK, BANK, PRE-MBANK and MBANK) while its competitors cut their prices by an additional 4.35% (coefficient on MBANK). These results suggest that firms react to the presence of financially weak rivals. This reaction could in fact contribute to drive the weak airline into bankruptcy.

So far, we have assumed that the error term has the usual property (distributed iid normal with finite variance). This is probably restrictive as we may expect that the error term is serially correlated and the error terms of two airlines on the same route at the same time are correlated. Ignoring these correlations may lead to a bias in the estimated standard error of the coefficients that could result in misleading inferences. We re-estimate model 1 with the following error structure:

Table 8
Introduction of a lead on BANK and MBANK

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimated coefficient (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-BANK</td>
<td>0.0163*** (0.0085)</td>
</tr>
<tr>
<td>PRE-MBANK</td>
<td>−0.0103*** (0.0060)</td>
</tr>
<tr>
<td>BANK</td>
<td>0.0155*** (0.0091)</td>
</tr>
<tr>
<td>MBANK</td>
<td>−0.0449* (0.0063)</td>
</tr>
</tbody>
</table>

* Significant at 0.01%.
*** Significant at 0.1%.

Table 9
Impact on prices of a lead on BANK and MBANK

<table>
<thead>
<tr>
<th>Status</th>
<th>Estimated effect on prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>The airline will go under Chapter 11 protection within 12 months</td>
<td>+0.6%***</td>
</tr>
<tr>
<td>Rivals of a firm that will go under Chapter 11 protection within 12 months</td>
<td>−1.02%***</td>
</tr>
<tr>
<td>Chapter 11 firm</td>
<td>−2.31%***</td>
</tr>
<tr>
<td>Rival of a Chapter 11 firm</td>
<td>−5.37%*</td>
</tr>
</tbody>
</table>

* Significant at 0.01%.
*** Significant at 0.1.

The estimated effects are computed using the following formulas: (1) effect = \( \exp[\log(100) + (0.0163 - 0.0103)] - 100 \); (2) effect = \( \exp[\log(100) - 0.0103] - 100 \); (3) effect = \( \exp[\log(100) + (0.0163 - 0.0103 + 0.0155 - 0.0449)] - 100 \); (4) effect = \( \exp[\log(100) + (-0.0103 - 0.0449)] - 100 \).

35 F-value of 0.5588 with (1, 10,035) degree of freedom.
36 Note that the magnitude of the price decrease by rivals of a weak competitor (−1.02%) is relatively small. However, as noted by a referee, this small average price cut may, in fact, result from much larger price cuts in some specific high margin market segments (such as, for example, non-restricted coach fare).
The error terms for two carriers on the same route at a particular time are correlated through a random effect while serial correlation is modeled as an AR(1) process. In Table 10, we reproduce the OLS and GLS estimates. The GLS standard errors are relatively close to those obtained using OLS and thus the results do not appear to be affected by taking into account these correlations in the error term.

All the results on the bankruptcy–pricing relation suggest that the impact of bankruptcy laws on firms’ competitive behavior is quite important. Given the large number of bankrupt carriers in the early nineties, these results seem to indicate that bankruptcy may have contributed, in part, to the industry’s poor financial results. However, it is important to stress the fact that prices appear to have been cut primarily by rivals of Chapter 11 airlines.

We assume that $\mu_r$ is random (and thus uncorrelated with the explanatory variables) to allow identification of variables such as MBANK that only vary with $r$ and $t$. Following Green (1994), we use GLS after transforming the data with the Cochrane–Orcutt transformation.

For example, in 1992, 70% of the routes in the sample had at least one bankrupt carrier.
5. Bankruptcy and costs

The results in Section 4 suggest that the bankruptcy status of an airline does not affect its pricing strategy directly, but only indirectly through its effect on costs. To provide further evidence on this, we examine the impact of bankruptcy on the airline’s average operating cost. We estimate the following equation:

$$\log(\text{COST}_{it}) = \gamma_0 + \gamma_i + \gamma_t + \gamma_1 \log(\text{DIST}_{it}) + \gamma_2 \log(\text{LOAD}_{it}) + \gamma_3 \log(\text{AAS}_{it}) + \gamma_4 \text{BANK}_{it} + \nu_{it}$$

where $\text{COST}_{it}$ is the operating cost-per-passenger-mile of airline $i$ at time $t$. $\gamma_i$ are fixed airline effects; they control for all the unobservables at the firm level such as the reputation or network structure (if these aspects are relatively stable over time). $\gamma_t$ are fixed time effects; they control for all the unobservables at the time level such as input price changes common to all carriers. $\text{DIST}_{it}$ is the average length of firm $i$ flights in its network at time $t$. We expect the average operating cost to decline as the average distance flown increases. $\text{LOAD}_{it}$ is the average load factor of airline $i$ at time $t$. We expect the operating cost-per-passenger-mile to decline as the percentage of seats filled increases. $\text{AAS}_{it}$ is the average aircraft size used by airline $i$ at time $t$. Larger aircraft should be associated with lower operating costs. $\text{BANK}_{it}$ is a dummy variable is equal to 1 if airline $i$ is operating under the protection of Chapter 11 at time $t$; it is 0 otherwise. $\nu_{it}$ is the error term.

We should point out that this is not a cost function per se as we have not included factor prices. This is justified by the fact that a reduction in factor prices may be a way for Chapter 11 carrier to lower costs, as suggested by the different examples presented in Section 2. The factor prices are, therefore, endogenous and the estimated equation may thus be viewed as a reduced form.

Using cost-per-passenger-mile as the left-hand side variable implicitly imposes the restriction of a constant return to scale technology. However, the fixed airline effects may capture a scale factor. As bankruptcy could also affect costs through changes in LOAD and AAS, we also report the results of a cost equation where these two variables are excluded.

The results of the cost equation are presented in Table 11. As the price equation suggested, the operating cost-per-passenger-mile significantly decreases after bankruptcy. It drops by about 4.2%. This is quite important. The magnitude of the effect is unaffected if we exclude the variables AAS and LOAD. It is interesting to note that the estimated cost reduction is consistent with the price equation results in Section 4. Indeed, a reduction of 4.2% in COST leads to a reduction in prices of about 2.3% (using the estimated coefficient in COST obtained in model 1 – Table 2). But, we found that the indirect effect of bankruptcy on prices using model 2 (Table 2) was about 2.34%.

These results suggest that developing a complete structural model of how bankruptcy affects cost would certainly be useful. Does the cost decrease result from a decline in factor prices such as

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We also estimate the cost equation with a measure of output (revenue-passenger-mile) as an explanatory variable. The results were not affected and the coefficient estimate on the output variable was not significant.
labor, or from an increase in technical or allocative efficiency? Such research is, however, beyond the scope of this paper and should be the focus of future work.

6. Conclusion

In this paper, we examine the impact of bankruptcy protection on airlines pricing policy in the US domestic market. From the estimation of a price and cost equation, we find the following pattern: it appears that a carrier that is within 12 months of being declared bankrupt does not charge significantly different prices than those charged in markets where no financially weak carrier is present. Its rivals, however, appear to cut their prices slightly. Once bankruptcy is declared, the Chapter 11 firm is able to reduce its operating costs which is partially reflected in its fares. The rivals of a Chapter 11 firm react to the bankruptcy by further lowering their prices. In all, these rivals cut their prices to a greater extent than the bankrupt carrier. The difference between the average price of the bankrupt firm and its rivals appears to be larger in dense markets. Our results also suggest an association between the rivals’ reaction and the fate of the Chapter 11 firm: the rivals’ price cut is significantly larger in markets where the Chapter 11 airline will not survive its bankruptcy phase.

These results may suggest some form of aggressive pricing by the rivals of a weak airline in an effort to force its exit or to affect the terms of a potential sale of its assets. Moreover, the magnitude of the rivals price cuts, as well as the large number of bankrupt carriers in the early nineties indicate that the presence of these troubled airlines may have contribute to the poor financial results of the industry during that period. Clearly, more evidence is needed to confirm these results and their interpretation. Several extensions of the present analysis could provide further evidence on the effect of Chapter 11 in the airline industry. For example, it would be interesting to look for possible links between the fate of the liquidated airlines and the behavior of their rivals. It would also be worthwhile to further examine how the Chapter 11 airline lowers its costs. Lastly, it would be valuable to try to specify and estimate the bankruptcy process. For example, are the rivals’

Table 11
Cost equation (dependent variable log(COST))

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimated coefficient (standard error)</th>
<th>Estimated coefficient (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(DIST)</td>
<td>-0.1425 (0.1122)</td>
<td>-0.2540** (0.1075)</td>
</tr>
<tr>
<td>log(LOAD)</td>
<td>-0.5915* (0.1263)</td>
<td></td>
</tr>
<tr>
<td>log(AAS)</td>
<td>-0.0763 (0.2463)</td>
<td></td>
</tr>
<tr>
<td>BANK</td>
<td>-0.0433*** (0.0257)</td>
<td>-0.0556* (0.0286)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.9589</td>
<td>0.9445</td>
</tr>
<tr>
<td>Number of obs.</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

* Significant at 0.01%.
** Significant at 0.05%.
*** Significant at 0.1%.
behavior responsible for the ill-fate of some troubled airline, or is it mostly the characteristics (such as network structure) and decisions of those troubled airlines that account for their bankruptcy?

Acknowledgements

We would like to thank D. Encaoua, R. Frank, G. Jakubson, G. Hay, R. Masson, R. Reed, M. Waldman, H. Wan, A. Zhang and four anonymous referees for their useful comments. The usual disclaimer applies.

Appendix A. Data and Variables

Record selection criteria: Some records were eliminated in aggregating the data by airline, route and time level. A record is defined at the airline, time, origin, destination, itinerary and price level. The following records were eliminated.
1. Records with non-credible fares. There are a variety of reporting errors in the O&D data. In particular, fares are occasionally misreported or miscoded. The DOT screening system and the screen developed by the G.A.O. (1990) are employed to identify these problems.
2. Records that correspond to unusual itineraries like open jaw tickets (example: Boston–Seattle–Tampa)
3. Records with itineraries that involve more than one connection each way.
4. Interline tickets. This is when a passenger uses more than one airline to complete one trip.
5. Non-coach class in any segment. Any business or first class tickets were eliminated.

Variables: The level of an observation is route-airline-time. To reach this level, different itineraries and price levels for the same route on an airline need to be aggregated. (For example, an airline that flies the route New York–Los Angeles, may have a direct flight or a indirect flight going through Chicago.) The different variables were aggregated using the number of passengers on the different itineraries as a weighting system.

Mean and standard deviation for the sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P )</td>
<td>163.31 (22.22)</td>
</tr>
<tr>
<td>BANK</td>
<td>0.096 (0.2954)</td>
</tr>
<tr>
<td>MBANK</td>
<td>0.3395 (0.4735)</td>
</tr>
<tr>
<td>COST</td>
<td>0.1484 (0.0234)</td>
</tr>
<tr>
<td>LOW-COST</td>
<td>0.1303 (0.0171)</td>
</tr>
</tbody>
</table>
References