Business, Financial, and Total Risk in Air Transport: A Comparison to Other Industry Groups Prior to September 11, 2001

The US airline industry's profitability has fluctuated violently over the past several decades. Record losses in the early 1990s turned into record profits during the late 1990s. Now the carriers are once again reporting record losses. The purpose of this paper is to explore one cause. All firms and industries face different levels of business, financial, and total risk. These risks cause volatility in operating profits (returns on assets) and in after-tax profits to stockholders (returns on equity). It is the interplay of these risks that is the key to understanding the volatile nature of air transportation profits. The purpose of this paper is to statistically measure risk, demonstrate the effects of risk on returns, and compare the airlines to other industrial groups. It will be shown that the airline industry is high in business risk and financial risk and that this combination causes a lot of the industry's profit volatility problems.

by Richard D. Gritta, Garland Chow, and Edward Freed

The US airline industry has experienced dramatic changes in profitability over the past decade. The record losses of the early 1990s were supplanted by the record profits of the mid- and late-1990s. Now a recession and the terrible events of September 11, 2001 have once again injured the industry. Several carriers have merged or attempted to merge and others may have to seek court protection to survive.

All industries and companies face risks resulting from the particular operating and financial structures in which they function. Clearly the interplay of these risks has a lot to do with the past and current situation facing the carriers. The purpose of this paper is to assess the risk and returns of the US airline industry and to compare these factors across a range of industry groups for the years 1996-2000.[1] It will be argued that the mix of relatively high business and financial risk that is characteristic of most air carriers has resulted in returns that are below the average but which are more volatile than most other industries. Data for 2001 were deliberately excluded to make the case more convincing.

The paper will also discuss the general nature of risks. The financial strategies of US carriers can only be understood in terms of the risk/return tradeoffs present in the airline industry. Next, the paper will measure those risks, using several widely accepted measures computed from the carriers' income statements and balance sheets. Carrier returns will also be measured and the carriers' performance will be compared and contrasted to that of a large sample of other industrial groups. Implications for the future will be reserved for the Conclusion.

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The Nature of Industry Risks

All companies and industries face three levels of risk (Moyer, McGuigan, and Kretlow 2001). These are business risk, financial risk, and total or combined risk. It is critical to understand the nature of these risks at the outset.

Business risk describes the instability of operating profits and operating returns on assets. Industries or firms that are high in business risk have more unstable operating profits (often called EBIT or earnings before interest and taxes) over time than those industries/firms that are low in risk. This risk is inherent in the industry in which a firm operates and it is caused by several factors that lie outside managerial control. Primary among these factors are:

- The presence of fixed costs in the operating structure of the firm. Often referred to as operating leverage, fixed costs act as a lever to increase the variability in operating profits as operating revenues change.[2]
- The presence of volatile input factor costs, such as labor and fuel. Cost control is far more difficult when input factor costs are unpredictable.
- The cyclical nature of the business. Industries or firms that are cyclical (that is, which are prone to) are higher in business risk than firms that are noncyclical.
- The level of competition within the industry. The more competitive the industry, the greater will be the risk. Control over pricing becomes more difficult and thus revenues become unstable.

Financial risk is defined as the added instability introduced into returns to stockholders resulting from the use of long-term debt to finance the firm's capital structure. It is caused by interest on the debt used to finance assets. As such, this risk is the result of managerial decisions, rather than the environment in which the firm operates. Interest on debt creates two problems. First, it increases the variability of earnings to stockholders. Because interest is a fixed charge, it acts as a lever on operating profits. Second, because it is a legal obligation of the firm, high interest expenses increase the probability that the firm may default and thus become insolvent.

The final level of risk is total or combined risk. It is the result of the dynamic interaction of both business and financial risk. It is the total variability in returns to stockholders. The cause of this risk is the combination of all the above factors. The problem is that levers in finance are much like levers in physics. They interact multiplicatively. That is, one lever, interest on debt, magnifies what the other lever, fixed costs, has already magnified. But leverage is thus a "two-edged" sword. It can magnify returns if revenues increase, but it works in the opposite direction if revenues fall. The net result of overleverage can be large changes in rate of return to stockholders resulting from small changes in operating revenues. Because of this interaction, a sound principle of finance holds that firms which are high in business risk should avoid heavy debt burdens, so as to moderate total risk. The failure to do so can result in very unstable returns to stockholders.

Risks Across Industries

Most analysts consider the airline industry to be very high in business risk. John Frederick was the first to refer to the high business risk nature of air transport (Frederick 1961). Others have confirmed this statistically (Gritta, Freed, and Chow 1998). Fixed costs are relatively high (about 25-30% of operating revenues), volatile factor input costs such as labor and fuel account for 15% and 30%, respectively, of airline total costs; the demand for air travel is very cyclical, and the industry has been competitive in many markets

since the advent of deregulation in 1978. Thus, carriers fit the profile described above of an industry high in business risk.

Table 1 summarizes several risk measures that allow a comparison between air transportation and a large random sample of 25 other industrial subcomposites or about one-third of the firms in the *Value Line Investment Survey.* The carriers in the sample include all those in the *Value Line* Air Transport Group. They are American, Airborne, Alaska, British Air, Continental, Delta, FedEx, KLM, Midwest Express, Northwest, Southwest, UAL, UPS, and USAir.

Column 1 of Table 1 presents the operating ratio (OPR) widely used by transportation analysts to measure profitability (Rickenbacker 1953; Gritta 1979). The operating ratio is the ratio of operating expenses to operating revenues. The OPRs shown are the five-year average ratios for the period, 1996-2000. To control for the impact of September 11, the data do not include the year 2001.

The significance of the OPR stems from the fact that it can be put into a formula that directly measures the instability of operating profits. Thus, it is an excellent measure of business risk. The higher the OPR, the greater will be the variability in operating profits given changes in operating revenues, and vice versa. The following formula expresses this relationship mathematically, where E is the elasticity or rate of change in operating profits given a 1% change in operating revenues:

$$(1) \quad E = 1\%(1\text{-}t)/[1\text{-}OPR]$$

where t is the tax rate faced by the firm.[3]

For example, if a firm's OPR is 90% (or 0.9), then that firm's operating profits will change by 7% for each 1% change in its revenue (assuming an average tax rate of 30%, the average paid by the carriers over the past five years).

$$(2) \quad E = 1\%(1\text{-}.30)/[1\text{-}.90] = 7\%$$

In contrast, if a firm's OPR is 50% (0.50), then that firm's operating profits will only change by 1.4% for each 1% change in its operating revenues at the 30% tax rate. The formula produces an even greater volatility index (10%) if the tax rate is 0%. Since many carriers have faced 0% tax brackets in the not too distant past, this latter point is relevant in the long run, especially given the profitability problems now faced by the industry. Even when many of the carriers earned profits in the late 1990s, tax rates remained low because of tax rules that permit the carry-back and carry-forward of losses in the years that the carriers had made those profits.

A comparison of the OPRs shown in the first column of Table 1 is revealing. The airlines have an average OPR of 89.4% for the time period, indicating that a 1% change in operating revenues would lead to a 6.6% change in operating profits, a high elasticity. In general, operating ratios around 90% or greater are considered high and indicate high business risk (Gritta 1979). A comparison to the other industry groups shows the airlines to be near the top of the list as the chart has industry groups ranked in descending order of OPR. The airlines are ranked sixth out of 26.

Financial risk can be measured by the debt/equity (D/E) ratio. It is computed by dividing long-term debt by stockholders' equity and is widely used by stockholders, bankers, bondholders, and other creditors to assess financial strength. Most analysts (Moyer, McGuigan, and Kretlow 2001) regard a ratio of 1:1 as a maximum standard, although this is a general rule of thumb. A ratio of 1:1 indicates that bondholders have financed $1 for every $1 that stockholders have contributed. The higher the ratio, the greater the financial risk facing the firm. Column 2 of Table 1 are the D/E ratios for all the industrial groupings. The airlines aver-

TABLE 1: Risk and Return Measures for Various Industries—1996-2000

	(1) OPR	(2) D/E	(3) ROA	(4) σ_{ROA}	(5) CV_{ROA}	(6) ROE	(7) σ_{ROE}	(8) CV_{ROE}	(9) ΔCV
Motor Carriers	93.2	0.53	10.0	3.49	0.35	12.80	3.92	0.31	-0.04
Chemicals-Basic	92.8	0.21	3.80	3.41	0.90	3.62	3.60	0.99	0.10
Retail Stores	92.2	0.69	10.6	0.46	0.04	15.30	1.04	0.07	0.03
Electronics	92.1	0.29	6.55	2.89	0.44	8.40	3.74	0.45	0.00
Natural Gas-Div.	89.6	1.09	7.62	2.18	0.29	11.98	4.33	0.36	0.08
Airlines	**89.4**	**1.27**	**8.04**	**7.06**	**0.88**	**13.00**	**12.40**	**0.95**	**0.08**
Building Mats	89.1	0.58	13.48	1.10	0.08	18.44	1.32	0.07	-0.01
Tire and Rubber	89.0	0.58	9.00	3.50	0.39	11.30	4.30	0.38	-0.01
Textiles	88.6	1.78	5.90	2.38	0.40	12.20	2.74	0.22	-0.18
Computers	87.2	0.23	15.8	1.98	0.12	19.05	2.84	0.15	0.02
Auto	87.0	1.40	6.00	3.00	0.50	12.00	6.00	0.50	0.00
Office Equip.	86.9	1.02	11.7	0.20	0.02	20.30	0.50	0.02	0.01
Machinery	86.7	0.85	9.48	1.58	0.17	14.60	3.00	0.21	0.04
Steel-General	86.5	0.28	8.90	5.85	0.66	10.65	6.90	0.65	-0.01
Paper Products	85.5	0.89	5.53	1.01	0.18	7.40	2.02	0.27	0.09
Tobacco	83.8	0.94	27.7	6.20	0.22	47.00	9.30	0.20	-0.03
Metals-Fabric.	83.4	0.37	11.4	0.56	0.05	14.75	1.42	0.10	0.05
Precision Instru.	82.0	0.32	17.3	0.50	0.03	21.90	0.43	0.02	-0.01
Chemicals-Div.	80.9	0.65	10.9	1.26	0.12	16.42	1.70	0.10	-0.01
Maritime	79.8	1.26	4.83	0.31	0.06	6.38	0.54	0.09	0.02
Beverages	79.5	0.76	16.1	1.40	0.09	24.70	3.30	0.13	0.05
Semi-Conduct	74.8	0.16	12.5	5.92	0.47	14.18	6.56	0.46	-0.01
Railroads	74.0	0.90	6.15	0.30	0.05	8.50	0.40	0.05	0.00
Power	72.1	1.74	5.23	0.73	0.14	10.05	4.10	0.41	0.27
Drugs	71.7	0.21	23.4	1.45	0.06	27.96	1.56	0.06	-0.01
Petroleum	52.0	0.79	6.82	3.95	0.58	10.98	5.11	0.47	-0.11
MEANS	**83.5**	**0.80**	**10.6**	**2.41**	**0.28**	**15.15**	**3.58**	**0.30**	**0.02**

Source: All figures are computed from raw data in the Value Line Investment Survey

age ratio for the period is 1.27, indicating that bondholders are investing $1.27 for each $1 of equity. More importantly that ratio is the fourth highest on the chart, exceeded only by the US textile industry (1.78), and by the Power (1.74) and Auto (1.40) industries. It is also just above that of the Maritime (1.26) group. Each of these industries, however, has a lower OPR. Note especially the OPRs for the Power (72.1%) and the Maritime groups (79.8%). In addition, it should be noted that many of the industries with higher OPRs than the airline industry have significantly lower D/E ratios than the airlines. Motor carriers have the highest OPR (93.2%), but a low D/E ratio of only 0.53.

Clearly, then, high levels of both business and financial risk have characterized the US airline industry during the period under study. But what has been the effect of the combination of risks in comparison to the other industries?

The Results of Leverage

Financial theory would suggest that firms, which are high in business risk, would have more unstable operating profit levels than firms lower in such risk. This would translate into more variable returns on assets (or ROA). ROA is the ratio of operating profit to total assets. Volatility can be gauged by computing the mean and standard deviation of ROA to produce the coefficient of variation (CV), the standard deviation divided by the mean (Moyer, McGuigan, and Kretlow 2001).

Theory would also suggest that those firms/industries using significant amounts of long-term debt to finance assets would add to the volatility of after-tax returns to stockholders, especially when faced with high levels of business risk. This return is often referred to as the rate of return on equity (or ROE). It is calculated by dividing net profit after taxes by stockholders' equity. The volatility in ROE can be gauged by its mean, standard deviation, and CV around the mean ROE. The latter measures the total variability caused by both business and financial risk. Finally, the incremental variability in the ROE can be assessed by examining the incremental change in the CV, which is:

$$(3) \qquad \Delta CV = CV_{ROE} - CV_{ROA}$$

The greater the difference in ΔCV, the greater is the measured financial risk.

Columns 3-9 in the table provide the details. At the operating level, over the past five years, the airlines have had an average ROA of only 8.04%. This is well below the 10.6% average of all the industry groups and it is exceeded by 15 of the 26 industrial categories. The standard deviation of this return was 7.06%. It is the largest absolute deviation and is well above the 2.41% average for all industries in the sample. Ranked in terms of relative business risk using the CV_{ROA}, the airline group (0.88) was second only to Basic Chemicals (0.90). The measured business risk is far above the average CV_{ROA} of 0.28 for all industries in the sample.

At the total risk level, the 13.0% ROE earned by the airlines was below the mean of 15.2% and was exceeded by 14 of the 26 industries in the sample. The carriers' ROE standard deviation of 12.4% was the highest in the sample, dwarfing the average of 3.58%. The carriers' CV_{ROE} of 0.95 ranked the group as second in total risk.

Lastly, the ΔCVs gauge financial risk, as noted above. The ΔCV for the airlines was the fourth highest (tied with the Natural Gas group) and was exceeded only by the Chemicals-Basic, Paper Products, and Power industries. The effect of both the high business and the high financial risk of the carriers is clearly demonstrated by these figures.

Conclusion

This paper has examined the level of business, financial, and total risk in the US airline

industry and compared the carriers to a broad sample of other industries. The evidence clearly shows the carriers' level of total risk was very high during the period, 1996-2000. The mix of high business and financial risk has been the culprit. The net result has been returns that are below the average but which are more volatile than most other industries. Sound financial theory suggests that firms/industries attempt to balance total risk. Those firms/industries high in business risk should constrain the amount of financial risk accepted. The failure of the airlines to do this is significant and may become more so in the future, especially since the net results of September 11 are deliberately not reflected in this analysis.

What are the implications for the future? The carriers face a difficult road ahead.[4] Once again the industry is under severe financial stress. Even when the impact of the tragedy of 2001 subsides, and the economy pulls out of the recession, the carriers will still face the inescapable fact that, on average, their balance sheets are top heavy with debt.[5] It will be difficult to correct this situation, but the long-run survivability of many of the carriers depends on doing just that.

Endnotes

1. An earlier version of this paper was presented at the Annual Meeting of the Air Transport Research Society (World Conference on Transport Research) at Boeing in Seattle, Washington, on July 5, 2002. This paper updates and expands a prior study by two of the authors (Gritta, Chow, and Shank 1993).

2. Since fixed costs are, by definition, fixed, operating profits will change more than operating revenues. For example, assume that revenues are $10.0 million and that the ratio of variable costs to revenues is 20% (or $2.0 million) and that fixed costs are $6.0 million. Operating profit would then be $2.0 million ($10.0-2.0-6.0). If revenues increase 100% to $20.0 million, operating profit would increase to $10.0 million ($20.0-4.0-6.0). On a 100% increase in revenues, operating profits have increased fivefold.

3. For a derivation of the formula using an income statement approach, see Gritta 1979. David Kosh originally used the formula in testimony presented before the Civil Aeronautics Board in Docket 21866-8 of the Domestic Passenger Fare Investigation (Kosh 1970).

4. It must also be remembered that the time horizon in this study coincides with the best profit performance in airline history. Several factors had a considerable impact on creating those profits. Those factors included very low fuel costs, major concessions from labor, record low interest rates, reduced capacity (through mergers and alliances), and the record economic expansion of the 1990s. There was one other very important factor and that was the tremendous operating and financial leverage present in this industry. It served to inflate the profits to the levels noted in this study. Many of these factors are now hurting the carriers. Labor is restless, fuel costs have spiked upwards, and the economy is growing very slowly.

5. Not all the carriers have followed imprudent financial strategies. Southwest, and to some degree Alaska, have followed more conservative policies (Gritta, Freed, and Chow 2000).

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