Operating, Financial and Total Leverage and the Effect on U.S. Air Carrier Returns, 1990-2003

Author(s): Richard D. Gritta, Brian Adams, and Bahram Adrangi

Source: *Journal of the Transportation Research Forum*, Vol. 45, No. 2 (Summer 2006), pp. 57-68

Published by: Transportation Research Forum

Stable URL: http://www.trforum.org/journal

Operating, Financial and Total Leverage and the Effects on U.S. Air Carrier Returns, 1990-2003

by Richard D. Gritta, Brian Adams, and Bahram Adrangi

The U.S. airline industry has always been highly cyclical and somewhat fixed cost driven. The carriers are thus high in what financial analysts refer to as operating leverage. In addition, the majority of the airlines have followed aggressive debt strategies; that is, they have chosen to use large amounts of long-term debt finance to purchase assets. This results in a high degree of financial leverage. In the past, the resulting combined leverage has created severe financial problems for many in the industry. This paper will examine these different levels of leverage using elasticity measures borrowed from economic theory. The purpose is to examine the effects of this leverage during the years in which the carriers saw unprecedented growth and a return to profitability. It will also compare and contrast several carriers (such as Southwest) which have avoided the "boom and bust" cycle of this industry as well as the effects of 9/11. The sample will consist of the major U.S airlines and several of the group referred to as "nationals."

INTRODUCTION

The history of the U.S. airline industry has been composed of a series of "boom/bust" cycles, capped by periods of near panic. The record losses of the early 1990s were followed by the record profits of the late 1990s, only to be supplanted again by the record economic losses starting in 2000 (and exacerbated by the events of 9/11). Since deregulation, more than 145 carriers have filed for receivership, and the industry still remains in fragile shape in spite of the success of a few members like Southwest and Jet Blue. Many industry analysts argue that the industry's problems are the result of high labor costs, fuel cost spikes, overcapacity, etc. The authors do not deny the effects of these factors on the carriers' plight, but there is a deeper, more fundamental factor at work. That factor is the tremendous over-leverage, both at the operating and financial levels, in this industry. The purpose of this paper is to explore this leverage situation and examine the effects on air carrier profitability that results from this state.

THE NATURE OF RISK IN AIR TRANSPORTATION

Almost from the outset, some industry experts argued that the long-term stability of the airline industry was adversely influenced by both the operating and financial cost structures of its members, as well as by its cyclical vulnerability.[1] On the operating side, the pressures of an intensely competitive marketplace and the inherently high fixed-cost structure of the industry pose a continual threat to industry stability. On the financial side, the highly-leveraged nature of airline financing leaves the industry particularly vulnerable to increases in interest rates and/or economic downturns.

This paper examines some basic risk measures that have been proposed to assess risk in the airline industry by Gritta et al. (1998). Values for these risk measures have been computed for the major U.S. air carriers over the period 1990-2003 and are used to support the proposition that the airlines operate within a particularly risky environment. By highlighting the effects of leverage and the differences in carrier financial strategies, the paper will argue that high carrier debt burdens are inappropriate given the volatility of the industry.

All firms face three types of risk (Moyer, McGuigan, and Kretlow 2005). The three levels of risk are business risk, financial risk and combined risk. Business risk can be defined as the variability in a firm's operating profit, often referred to as earnings before interest and taxes (EBIT), over time

and is generally attributable to the inherent nature of the firm's operations and the environment within which it operates. This type of risk is driven primarily by the firm's cost structure, product demand characteristics, and intra-industry competitive position. Some companies may face high business risk solely because of external, and therefore, largely uncontrollable, factors such as high-fixed costs, the cyclical nature of its business, government regulation, and intense competition.[2] However, high business risk can also be the result of poor cost controls (the failure to hedge fuel costs or excess capacity), low productivity, or pricing practices which dilute revenues. The airline industry is high in business risk on virtually all these counts.

Financial risk is generally defined as the added variability in earnings available to a firm's common stockholders due to the use of debt to finance the acquisition of assets. It often represents the increased probability of insolvency that comes with excessive debt finance because interest on debt must be paid (unlike common stock dividends, which are paid at management's discretion). High financial risk may indicate that high interest charges are overwhelming a business enterprise, forcing it in some cases to seek court protection. Financial risk, unlike business risk, is not the product of the environment within which a company operates. Rather it results directly from a firm's conscious decision to use financial leverage (i.e., long-term debt or preferred stock) instead of issuing common stock to raise funds.

Combined (or total) risk, as the name suggests, refers to the risk that results from the interaction of both operating and financial risk. It is important to note that the interaction of the two risk types has a multiplicative, rather than an additive, effect. The impact of the combined effect can be extremely powerful, as will be evident from the discussion that follows.

An important measure of a firm's business risk is its degree of operating leverage, or DOL (Moyer et al. 2005). Operating leverage generally refers to the firm's incurrence of fixed operating costs. As a general rule, high fixed costs create more unstable DOLs. As an elasticity measure borrowed from microeconomic theory, DOL measures the relative changes in operating profits (OP or EBIT) given changes in operating revenues. That is, it measures the X% change in operating profits that would be induced by a 1% change in operating revenues. Equation (1) shows the calculation:

$$(1)\quad \text{DOL} = \frac{\%\Delta OP}{\%\Delta OR} = \frac{\dfrac{\Delta q(p-v)}{q(p-v)-F}}{\dfrac{\Delta qp}{qp}} = \frac{\Delta q(p-v)}{q(p-v)-F} x \frac{q}{\Delta q} = \frac{q(p-v)}{q(p-v)-F}$$

Where q is a firm's output and p, v and F are price per unit of output, variable cost per unit, and total fixed costs, respectively. Operating profit (OP or EBIT) is thus $q(p\text{-}v)\text{-}F$ and the change in EBIT that results from an increase in q is therefore $\Delta q(p\text{-}v)$ since fixed costs do not change (by definition). Since qp is total revenue (R) and qv is total variable cost (V), this can be simplified to:

$$(2)\quad \text{DOL} = \frac{R-V}{R-V-F}$$

The sign and the magnitude of DOL are both important indicators of risk. If revenues (R) exceed the sum of variable plus fixed costs (V+F), then the firm is above its operating break-even point and DOL is positive. A positive DOL indicates that as R increases, operating profits will increase (and vice versa). If DOL= +4.0, for example, this would indicate that a 1% increase in revenue would result in a 4% increase in EBIT. When R exceeds the sum of (V+F), DOL will take on a value between +1 and +∞. A relatively small positive value for DOL indicates a relatively low business risk (i.e., low variability in operating profit), since changes in revenue will induce relatively small changes in operating profits. In contrast, the higher the fixed cost burden (F) in relation to (R-V), the higher the measured DOL, indicating a significantly higher level of business risk. Note that if

the firm has no fixed costs ($F = 0$), then there is no operating leverage. Thus business risk would be low and DOL would equal +1.0.

If total costs ($V + F$) exceed operating revenues, then operating profits are negative and the situation is more severe. The negative sign indicates that when revenues increase, operating losses will decrease (and vice versa). In this case, relatively large absolute value for DOL implies a relatively high degree of variability in operating profits (losses), which can be dangerous since the firm is operating below its break-even point. But such large negative values can actually be interpreted as less serious than very low negative numbers, since large absolute values indicate that current losses are relatively small and that a small increase in operating revenues can be expected to cut deeply into operating losses. This smaller absolute value would be especially alarming since (1) it reflects the large size of current operating losses and (2) it implies that positive changes in operating revenues will have only a minimal effect on reducing those losses. Negative DOL values can range between 0 and $-\infty$.[3]

Finally, although fixed costs are generally seen as the key to determining the value of DOL, inefficient management policies affecting variable costs or gross revenues can also contribute to high business risk. In the airline industry, for example, factors such as poor cost controls or inefficiencies in a carrier's route structure can contribute to unfavorable DOLs. Reduced revenues caused by aggressive fare wars may have a similar effect.

Financial risk can be measured by its degree of financial leverage (DFL). This interest-driven measure reflects the responsiveness of net profit to changes in operating profit or EBIT. If I = interest, then as an elasticity measure, DFL=% change in net profit (NP) divided by a % change in operating profits (OP or EBIT), or more completely

$$(3)\quad \text{DFL} = \frac{\%\Delta NP}{\%\Delta EBIT} = \frac{\dfrac{\Delta NP}{NP}}{\dfrac{\Delta EBIT}{EBIT}}$$

Since $NP=R\text{-}V\text{-}F\text{-}I$ and $EBIT= R\text{-}V\text{-}F$, then

$$(4)\quad \text{DFL} = \frac{\dfrac{\Delta(R-V)}{R-V-F-I}}{\dfrac{\Delta(R-V)}{R-V-F}} = \frac{R-V-F}{R-V-F-I}$$

and this reduces to

$$(5)\quad \text{DFL} = \frac{\text{EBIT}}{\text{EBIT}-\text{I}}$$

As was the case with the concept of DOL, DFL is an elasticity measure, here measuring the percentage change in net profit ($R\text{-}V\text{-}F\text{-}I$) that would be produced by a 1% change in operating profits. It is usually assumed that tax rates are relatively constant, so that net profits before and after taxes will vary in unison. As in the case of DOL, both the sign and the magnitude of DFL are very significant.

A positive sign reflects the fact that the firm is above its financial breakeven (i.e., operating profits exceed interest). It also indicates that when operating profits increase, net profits will increase; when operating profits decrease, net profits will decrease. A low value of DFL here means that net profit is relatively large, (relative to operating profit), and that the variability in net profit (i.e., risk) is relatively small, and vice versa. For positive DFLs, values will range from +1 (when the firm is debt-free, i.e., when $I= 0$) to $+\infty$ (when I = Operating Profit).

When interest exceeds operating profit, the firm is showing a net loss and DFL is negative. This negative DFL means that an increase in operating profit will lead to a decrease in the firm's net loss and vice versa. As in the case of negative DOLs, small absolute values for negative DFLs are especially serious since they indicate (1) large net losses for the firm and, (2) a lack of net loss responsiveness to improvements in operating profits. Negative DFL values will range from $-\infty$ to 0. It should also be noted that if operating profits are negative, DFL will be reported as negative irrespective of the value of *I*.

Combined (or total) risk, the product of its business and financial risks, can be measured by its degree of combined leverage (DCL). The interaction of these risks is multiplicative, not additive. That is, it is similar to the effect of levers in physics. The second lever (interest) magnifies what the first lever (fixed costs) has already magnified.

(6) $$DCL = DOL \times DFL$$

$$= \frac{R - V}{R - V - F} x \frac{R - V - F}{R - V - F - I}$$

And

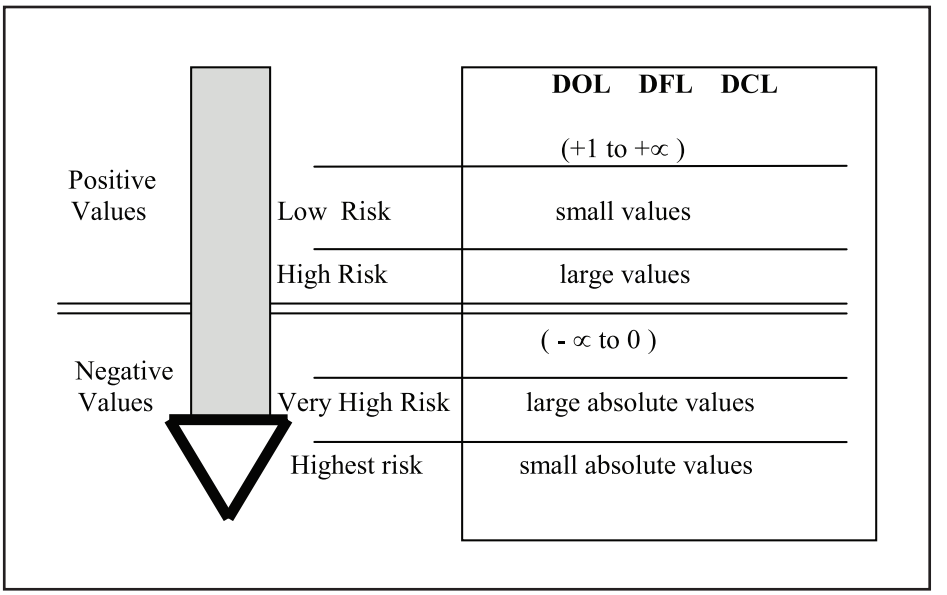
(7) $$DCL = \frac{R - V}{R - V - F - I}$$

As defined here, DCL measures the percentage change in net profit that would be produced by a 1% change in operating revenues. If revenue (R) is greater than total costs (V+F+I), then the firm is operating above its total breakeven point and DCL will be positive. In such a case, smaller DCL values indicate relatively low combined risk since fixed costs and interest would be relatively low when compared to revenue. In the extreme, if DCL is +1, combined risk is minimal since fixed costs and interest would necessarily be 0 (see equation 7). When total costs (V + F + I) exceed revenue, the firm is operating below its combined break-even point and DCL will be negative. As is the case with low absolute values for DOL and DFL, low absolute values for DCL are especially alarming here since they indicate that losses are large (F and I are high) and that responsiveness to improvements in revenue will be sluggish. Insolvency is more likely and the firm has a long way to go to restore profitability. It is important to note that, if either DOL or DFL is negative, or if *both* DOL and DFL are negative, DCL will be reported as negative. In other words, a negative times a negative does not equal a positive; it is the *absolute values* that are important in this case.

The multiplicative interaction that produces combined risk highlights the danger of employing debt finance (significant financial risk) when a company faces a high level of business risk. To illustrate, assume two companies face the same large positive DOL, perhaps a DOL of +20.0, indicating that a 1% decline in revenue can precipitate a twenty-fold decrease in operating profits. Airline X, perceiving the business risk it faces to be high, and wary of any downturn in the economy, decides not to utilize any long-term debt in its capital structure. It thus has a DFL of +1. Its resulting DCL is 20 x 1 = +20. Airline Y, on the other hand, chooses to ignore the incremental risk associated with debt financing and, as the result of interest on its debt, faces a DFL of +4.0. DCL for this firm is a far more dangerous +80 (20 x 4). Should the industry experience a slowdown in activity or face a recession, the latter carrier is clearly more vulnerable to failure. A 5% reduction in revenue will cause a 100% reduction in Airline X's net profits (5% x 20), a serious enough drop, but Y's net profits will plummet by 400% (5% x 80). The situation is even worse in cases where DCL values are negative with small absolute values, especially where such conditions persist over a long period of time. As suggested earlier, this is because the base of losses is so large that the financial solvency of the enterprise in the long run may be severely threatened. Of course, the situation is reversed if revenues increase. The levers then work in the positive direction.

Figure 1 should help clarify the discussion. As the arrow indicates, the direction of increasing risk is down the chart. It applies to all three measures of risk.

Figure 1: Direction of Increasing Risk for DOL, DFL or DCL



Because of the multiplicative effect of business and financial risks, most companies and industries try to balance risk. That is, a company high in business risk will tend to avoid significant long-term debt finance. A company low in business risk will be more likely to use debt finance since it will tend not to threaten the firm's basic stability.[4]

ANALYSIS OF AIR CARRIER RISKS AND EFFECTS ON RETURNS

Values for the leverage measures described above were calculated for the major U.S. air carriers for the years 1990-2003. Table 1 shows the calculated DOL, DFL, and DCL. Figure 2 graphs the median levels over time for the degrees of leverage for all the carriers. In the computation of these values, variable costs (V) were defined as the sum of flying operations, maintenance, passenger service, and air traffic costs. Fixed costs (F) are the summation of promotion and sales expenses, general and administrative costs, depreciation and amortization expenses, and various transportation-related costs. The accounts used are the standard account lines presented in the Department of Transportation (DOT) publication, *Air Carrier Financial Statistics.*

One point must be noted here: To the extent that some airline variable costs, such as fuel, are "sticky" or "constant" in the economic lexicon (or as accountants would say are step-variable in nature), the analysis of the DOL presented in this paper actually *understates* the true level of risk in the airline industry. Decades ago Caves (1962) argued that, to a large extent, costs which might appear to be structurally quite variable, may be in fact far less so in the airline industry. As traffic declines, classical variable costs, such as fuel, cannot be cut immediately in response to the decline in traffic. Hence, they behave in a "sticky" manner, increasing operating leverage as a direct result.

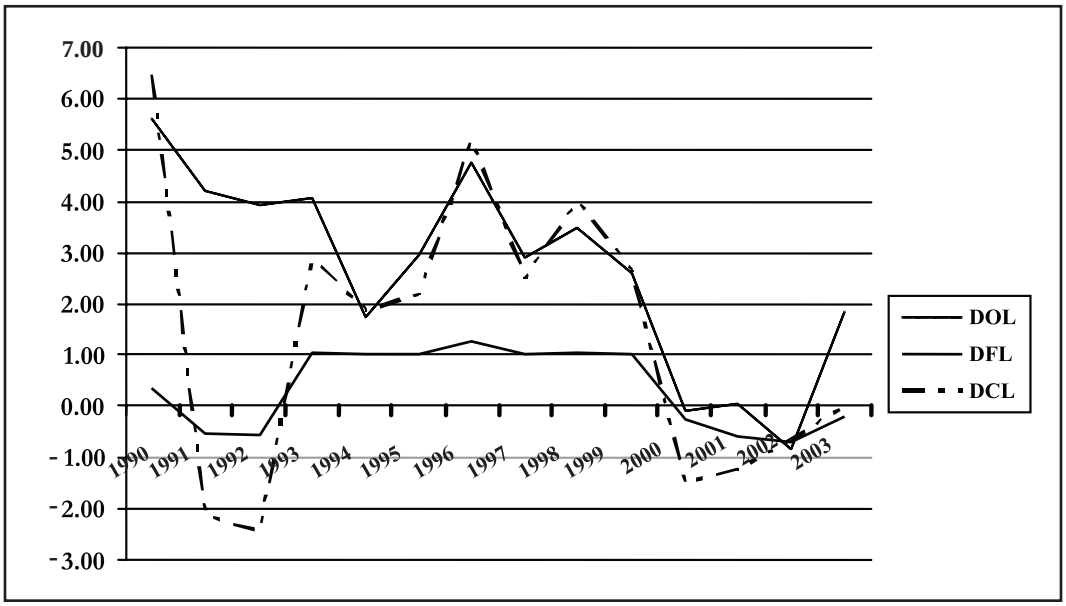
The difficult and volatile financial situation faced by the carriers is clearly evident from this exhibit.[5] The vast majority of the carriers have very unsettling degrees of operating leverage as measured by DOL. In spite of this, however, many carriers have followed aggressive debt strategies as evidenced by the high degrees of financial leverage (DFL). The significant swings in these

Table 1: DOL, DFL, and DCL Measures for the Years, 1990-2003

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
American	**DOL**	50.01	217.74	-54.42	9.02	6.36	6.2	4.12	3.89	3.41	5.37	4.38	-1.18	-0.42	-3.22
	DFL	-0.36	-0.05	-0.17	3.62	2.01	2.36	1.32	1.1	1.05	1.15	1.13	-0.91	-0.88	-0.75
	DCL	-17.92	-11.85	-9.07	32.67	12.76	14.59	5.44	4.28	3.58	6.18	4.95	-1.07	-0.37	-2.43
Continental	**DOL**	-5.97	-5.36	-7.1	-33.49	-16.51	7.02	5.06	3.54	4.11	5.68	4.91	-6.15	-4.27	55.09
	DFL	-0.52	-0.68	-0.62	-0.23	-0.31	3.96	1.46	1.19	1.2	1.57	1.48	-0.59	-0.6	-0.1
	DCL	-3.13	-3.64	-4.44	-7.56	-5.08	27.77	7.4	4.21	4.93	8.93	7.29	-3.63	-2.58	-5.4
Delta	**DOL**	-10.12	-10.69	-3.47	-13.19	-18.09	4.49	8.44	3.41	3.28	4.66	3.65	-3.23	-2.87	1.05
	DFL	-0.71	-0.61	-0.8	-0.51	-0.44	1.32	1.61	1.14	1.1	1.24	1.42	-0.71	-0.62	-0.63
	DCL	-7.22	-6.53	-2.76	-6.77	-8.03	5.91	13.62	3.88	3.62	5.79	5.19	-2.29	-1.78	-0.66
Northwest	**DOL**	-16.07	-41.86	-34.03	9.48	4.23	3.47	3.07	2.95	-17.27	4.13	4.82	-2.05	-2.11	-6.51
	DFL	-0.56	-0.24	-0.63	2.78	1.35	1.35	1.2	1.19	-0.33	1.73	1.81	-0.72	-0.67	-0.4
	DCL	-9.03	-10.01	-21.54	26.31	5.7	4.69	3.69	3.51	-5.77	7.14	8.73	-1.48	-1.42	-2.59
Southwest	**DOL**	11.1	4.36	3.72	3.18	3.52	3.98	3.96	3.19	2.89	2.82	2.52	3.41	4.42	3.85
	DFL	1.65	3.43	1.48	1.25	1.22	1.23	1.2	1.14	1.09	1.07	1.07	1.12	1.34	1.23
	DCL	18.27	14.95	5.5	3.96	4.3	4.9	4.76	3.63	3.15	3.03	2.71	3.83	5.91	4.73
TWA	**DOL**	-0.34	-1.93	-0.42	154.92	-4.75	27.08	-4.89	-31.04	-13.49	-2.01	-2.65	-0.36	n/a	n/a
	DFL	-0.32	-0.53	-0.77	-0.67	-0.55	-0.36	-0.64	-0.22	-0.37	-0.78	-0.73	-0.91	n/a	n/a
	DCL	-0.11	-1.02	-0.33	-103.52	-2.62	-9.64	-3.12	-6.86	-4.99	-1.56	-1.93	-0.33	n/a	n/a
United	**DOL**	-72.77	-8.16	-9.96	18.49	9.18	6.18	5.05	4.88	4.24	4.49	8.53	-0.27	-0.53	-1.99
	DFL	-0.27	-0.74	-0.63	-10.4	2.92	1.69	1.34	1.28	1.28	1.3	3.82	-0.88	-0.84	-0.76
	DCL	-19.77	-6.03	-6.31	-192.28	26.77	10.45	6.74	6.26	5.4	5.86	32.6	-0.24	-0.45	-1.5
USAir	**DOL**	-2.12	-7.35	-3.71	-13.23	-3.13	9.62	7.23	5.57	3.7	15.28	-65.02	-1.53	0.87	-5.06
	DFL	-0.8	0.53	-0.66	-0.37	-0.65	-3.95	3.53	1.77	1.29	20.13	-0.15	-0.8	-0.75	-0.65
	DCL	-1.69	-3.91	-2.43	-4.89	-2.03	-38	25.52	9.89	4.78	307.52	-9.82	-1.23	-0.65	-3.27
Alaska	**DOL**	17.64	14.1	-1.58	-7.52	5.38	5.02	92.32	7.34	2.92	3.26	-35.21	-6.06	-4.46	-41.6
	DFL	10.28	-1.69	-0.77	-0.51	2.2	2.22	1.57	1.23	1.1	1.08	-0.26	-0.58	-0.64	-0.2
	DCL	181.29	-23.88	-1.21	-3.8	11.83	11.12	144.76	8.99	3.2	3.51	-9.09	-3.51	-2.87	-8.15
America West	**DOL**	-12.17	-3.52	-5.08	4.44	3.98	4	1.46	1.39	3.76	3.76	-40.85	-0.64	01.73	18.28
	DFL	-0.32	-0.6	-0.57	1.81	1.64	1.66	3.54	1.32	1.24	1.22	-0.28	-0.87	-0.67	-0.37
	DCL	-3.9	-2.13	-2.91	8.04	6.53	6.62	5.18	1.84	4.68	4.59	-11.64	-0.56	-1.15	-6.78

measures (from positive to negative and in magnitude) are the root cause of the "boom and bust" nature of this industry. This is a pattern that has persisted for many decades, including the years before deregulation (Gritta et al. 1998). If the entire time period is considered, only Southwest is the exception to this rule. This should not be meant to minimize the effects of 9/11. There is no doubt that the leverage measures for the years, 2001-2003, were severely affected by the events of that date, but the effects were compounded by the poor financial condition of this industry prior to that date. The case of Southwest is strong evidence of that fact. This carrier has posted a profit in every quarter since 9/11.

Figure 2: Median DOL, DFL and DCL Measures, 1990-2003



What is more worrisome is the number of years where leverage has adversely affected (that is, has been negative) the carriers. Table 2 is a summary based on Table 1. It indicates the number of years that any leverage measure for each of the carriers was negative. (For example, American experienced six years of negative combined leverage due to either negative operating or financial leverage or to both.)

Table 2: Number of Years of Negative Leverage: 1990-2003 (14 years)

Airline	DCL	DOL	DFL	% of time negative
American	6	4	6	43%
Continental	8	7	8	57%
Delta	8	7	8	57%
Northwest	7	7	7	50%
Southwest	0	0	0	0%
TWA (12 years)	12	10	12	100%
United	7	6	7	50%
USAir	10	8	10	71%
Alaska	7	6	7	50%
America West	7	6	7	50%

The number of carriers that have experienced negative total or combined leverage over the 14-year period is simply appalling. Only Southwest can claim stability over the period. All of the other carriers are at 50% or higher. TWA, US Airways, Continental, and Delta are particularly noteworthy for their high rates of negative leverage. The pattern is similar to that found in a prior study (Gritta 1998). It is important to note the tremendous cyclicality of this industry as seen in Table 1. When things go well, they go very well. When they go bad, they go very bad. This is directly caused by the high degrees of operating leverage being compounded by the presence of significant degree of financial leverage over time. The latter leverage helps in good times but magnifies the losses in down years (especially when disasters such as 9/11 occur).

The effect of leverage on air carrier rates of return can be seen in the following tables. As discussed above, high degrees of operating leverage are associated with more variable EBIT levels. This will translate into more variable rates of return on assets (ROA), since ROA is EBIT divided by total assets (EBIT/TA). High degrees of financial leverage will then magnify those changes in EBIT into even more volatile changes in net profits. The total effect of leverage, gauged by DCL, will be to destabilize the returns to equity (ROE), which is defined as net profits/equity (NP/EQ).

The impact of the leverage detailed in Table 1 is clearly seen in the rates of returns in Table 3. Table 4 summarizes the results of Table 3. Table 4 shows the average (mean) rate of return on both assets and equity for each carrier and the standard deviation around that mean (SD). In addition, the median return (that return which divides the distribution in half) is added because of the fact that extreme values can distort the true picture.[6] Finally, the coefficient of variation (CV) is provided.

CV is computed by dividing the standard deviation of a population by its mean. It helps in comparisons when there are large differences in the cross-sectional means. A small positive CV value, lower volatility relative to positive firm performance, is viewed as stable strength. A small negative CV value, lower volatility relative to negative firm performance, is viewed as consistent weakness.

For a majority of the carriers, the CV of their ROA is positive and, as expected, Southwest has the strongest CV with a value of 0.4. The two exceptions are TWA and US Air, whose small negative ROA CVs confirm their steady poor performance over the sample period. ROE, which includes the effects of leverage, illustrates a much worse picture of the airline industry. All the airlines in our sample, save Southwest, have negative ROE CVs. The results in Table 4 confirm the negative effects of leverage on the sample of carriers. Again, 9/11 affects the results, but it is clear that this industry has been characterized by volatility for a long period of time.

CONCLUSION

The volatile financial situation faced by airline carriers is evident in the significant swings in the degrees of leverage and the consistently negative ROE ratios for the firms in the sample. With the exception of the consistently positive figures of Southwest and the consistently negative figures of TWA, the other eight airlines exhibit a predictable volatility over the 14 years of the sample, brought on by the effects of both operating and financial leverage. While the effects of the events of 9/11 cannot be ignored, they do not alter the fact that this industry has been overleveraged at both the operating and financial levels for a long period of time and this has resulted in the "boom and bust" cycle that plagues this industry. Furthermore, it is a repeat of the same pattern evident in the period right after deregulation (Gritta 1998). While difficult to address at this time, the carriers must ultimately face the facts and alter their financial patterns to reflect the high degree of operating leverage present in this industry.

Table 3: Air Carrier Rates of Return on Assets and Equity for the Years, 1990-2003

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
American	ROA	0.54%	0.12%	-0.44%	3.18%	5.12%	5.37%	7.35%	8.15%	9.09%	4.61%	5.37%	-9.08%	-11.98%	-5.46%
	ROE	-6.24%	-8.31%	-14.72%	4.91%	14.05%	11.27%	22.25%	24.62%	25.85%	12.19%	17.09%	-43.49%	-214.50%	-555.23%
Continental	ROA	-7.82%	-8.33%	-6.29%	-0.91%	-2.02%	5.69%	8.93%	11.91%	9.73%	5.71%	6.49%	-3.51%	-4.56%	0.28%
	ROE	-26.71%	-19.19%	-14.66%	-28.44%	-270.28%	19.64%	46.46%	59.13%	46.00%	19.13%	34.52%	-50.26%	-69.94%	-26.52%
Delta	ROA	-3.16%	-2.93%	-8.07%	-2.36%	-1.90%	8.69%	4.77%	12.36%	12.28%	6.40%	7.03%	-4.22%	-4.44%	-4.84%
	ROE	-15.43%	-18.76%	-37.02%	-28.34%	-29.19%	36.95%	13.90%	40.51%	39.14%	19.70%	19.41%	-33.53%	-42.54%	-82.84%
Northwest	ROA	-1.95%	-0.75%	-3.79%	3.87%	9.32%	8.51%	9.79%	9.70%	-0.93%	5.55%	4.74%	-4.83%	-4.45%	-1.48%
	ROE	-10.45%	-10.54%	-24.48%	5.82%	25.00%	19.17%	20.74%	19.80%	-8.76%	9.37%	7.28%	-24.90%	-44.70%	-20.18%
Southwest	ROA	5.55%	3.37%	7.94%	11.60%	10.32%	9.47%	9.39%	12.35%	14.53%	13.81%	15.27%	7.01%	4.66%	4.88%
	ROE	8.15%	2.87%	14.38%	22.08%	19.17%	17.54%	17.68%	15.34%	26.19%	25.67%	27.56%	14.00%	7.06%	7.77%
TWA	ROA	-4.91%	-12.89%	-17.45%	-8.52%	-8.63%	1.40%	-7.41%	-1.05%	-2.55%	-16.01%	-11.54%	-21.54%	-4.77%	7.07%
	ROE	-71.88%	-82.93%	-41.59%	-2024.16%	-100.22%	-37.06%	-131.35%	-49.35%	-95.03%	-257.86%	-73.99%	-215.80%	-163.52%	402.67%
United	ROA	-0.68%	-4.95%	-4.11%	2.43%	4.29%	7.30%	8.76%	7.61%	7.62%	6.30%	1.88%	-14.54%	-12.16%	-6.84%
	ROE	-11.29%	-41.17%	-106.15%	-4.21%	-316.15%	354.71%	62.11%	35.34%	30.97%	18.61%	2.18%	-123.41%	-425.76%	-45.36%
USAir	ROA	-8.39%	-3.07%	-5.59%	-1.89%	-7.57%	3.44%	4.98%	7.09%	11.25%	2.13%	-0.39%	-11.58%	-10.54%	-5.05%
	ROE	-28.68%	-18.13%	-66.39%	-85.32%	-284.88%	-19.10%	-122.70%	29.98%	45.08%	0.55%	-16.56%	-378.57%	-45.59%	-735.66%
Alaska	ROA	1.73%	1.78%	-10.01%	-2.81%	4.99%	5.74%	6.47%	9.71%	12.59%	8.92%	-0.51%	-2.36%	-2.86%	-0.34%
	ROE	0.52%	-3.09%	-48.46%	-21.85%	9.85%	10.49%	14.41%	25.08%	32.37%	24.51%	-6.81%	-16.19%	-22.07%	-7.76%
America West	ROA	-2.66%	-9.24%	-7.08%	11.69%	9.47%	10.06%	4.30%	10.51%	12.41%	11.90%	-0.71%	-17.81%	-10.05%	1.32%
	ROE	-230.56%	-119.85%	-47.63%	-28.42%	14.97%	14.39%	3.11%	17.95%	20.69%	18.41%	-5.07%	-49.86%	-82.41%	-18.18%

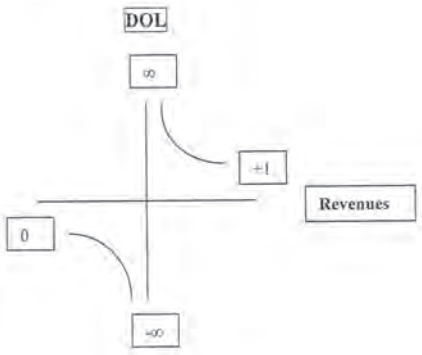
Table 4: Average Returns and Variability Measures, 1990-2003

Carrier	Return	Average	SD*	Median	CV
American	ROA	1.6%	6.4%	3.9%	+4.0
	ROE	-50.7%	157.6%	8.1%	-3.1
Continental	ROA	1.1%	6.9%	-0.3%	+6.3
	ROE	-20.1%	82.0%	-16.9%	-4.1
Delta	ROA	1.4%	6.9%	-2.1%	+4.9
	ROE	-8.4%	37.1%	-17.1%	-4.4
Northwest	ROA	2.4%	5.6%	1.6%	+2.3
	ROE	-2.6%	21.1%	-1.5%	-8.1
Southwest	ROA	9.3%	3.9%	9.4%	+0.4
	ROE	16.1%	7.7%	16.4%	+0.5
TWA	ROA	-7.8%	7.8%	-8.0%	-1.0
	ROE	-210.2%	543.5%	89.0%	-2.6
United	ROA	0.2%	7.7%	2.2%	+38.5
	ROE	-40.7%	179.9%	-7.8%	-4.4
US Air	ROA	-1.8%	6.9%	-2.5%	-3.8
	ROE	-123.3%	212.4%	-37.1%	-1.7
Alaska	ROA	2.4%	6.1%	1.8%	+2.5
	ROE	-0.6%	22.1%	-1.3%	-36.8
America West	ROA	1.7%	9.9%	2.8%	+5.8
	ROE	-35.2%	70.4%	-11.6%	-2.0

*SD is standard deviation

Endnotes

1. Frederick (1961) was one of the first to discuss the cost structure of the air carriers and its effects on risk. That the industry has been very cyclical has been demonstrated in several early studies, including Ghosal (1981) and Jung and Fugii (1976). This was long before deregulation increased its cyclicality.
2. Brigham (2004) has noted that airlines must invest heavily in fixed assets, which results in high operating leverage. This situation is therefore, to some degree, outside the control of management.
3. To demonstrate this fact, assume that a carrier has revenues of $100 million, variable costs of 50% of revenues and fixed costs of $400 million. Obviously, the carrier is in serious trouble. DOL = [$100-$50]/ [$100-$50-400] = -0.14 and the EBIT level is a huge loss of $350 million. Now assume that revenue increases by 100% to $200 million. EBIT will only go up by $50 million (that is, losses decrease from $350 to $300 million since [R-V-F] = [$200-$100-$400]. The rate of change in EBIT is only a very small 14% ([300-350]/350) because the loss is so large. Note that dividing the rate of change in EBIT by the rate of change in revenue results in the DOL = -0.14 (-14%/100%). In the shutdown case DOL=0, but as revenues increase DOL "improves" by moving along the bottom left quadrant from small negative numbers to large negative numbers to -∝. Past the break-even point, as revenues continue to rise, DOL begins to fall from a +∝ until is reaches a +1.0. If there are no fixed costs, then DOL = [R-V]/[R-V-0]. DOL thus moves from the bottom left quadrant, moving left to right, to the top right quadrant, again moving left to right. (See also Figure 1). The same also applies to DFL and DCL.



4. The need to balance business and financial risk is a principle of finance advanced in virtually every financial management textbook (Moyer et al. 2005). Gritta (1975) and Gritta, Seal and Hicks (2003) found this to be true in several empirical studies contrasting levels of business, financial and total risk facing the U.S carriers with risks levels in a large sample of other industries.

5. As described earlier, the most severe conditions a carrier can face are: (1) small negative DOLs, DFLs, and DCLs, the latter being the most severe; and (2) volatile DOLs, DFLs, and DCLs over time. There are several reasons for this. First, very small negative DCLs indicate considerable financial distress since net profits (EBIT-I) are strongly negative and the carrier could default on loan payments (interest, principal, and lease obligations.) Several bankruptcy studies (Goodfriend et al. 2004) and (Gritta, Davalos, and Chow 2003) clearly demonstrate the effect of excess leverage on carrier solvency. For a list of all the studies, see Gritta (2005). Second, extreme volatility is abhorrent to stockholders and other investors, unless compensated by commensurably higher rates of return. Investors, ex-ante, must perceive that they will be rewarded for assuming risk. Ex-post, their expectations may not be fulfilled (Jones 2004).

6. For example, American's huge negative ROE of -555.2% distorts the average return for that carrier because the negative return is so large. In turn, that return is distorted by the carrier's very small positive equity, itself a function of past losses reducing its equity base.

References

Brigham, Eugene and L. Gapenski. *Intermediate Financial Management*. Dryden Press, Orlando, Florida. Ch. 12, 2004.

Caves, Richard. *Air Transport and Its Regulators*. Harvard University Press, Cambridge, Massachusetts. p. 82, 1962.

Department of Transportation. *Air Carrier Financial Statistics Quarterly*. Various issues.

Frederick, John T. *Commercial Air Transportation*. 4ed. Richard D. Irwin Inc., Homewood, Illinois. pp. 331-332, 1961.

Ghosal, Animesh. "Price Elasticity of Demand for Air Passenger Service: Some Additional Evidence." *Transportation Journal* 20 (4), (1981): 93-96.

Goodfriend, Jason, R.Gritta, B. Adrangi and S. Davalos. "Assessing the Financial Condition of the Major U.S. Passenger Airlines Over the 1993-2003 Period Using the P-Score and Z-Score Discriminant Models." *Credit and Financial Management Review* 10 (4), (2004): 41-52.

Gritta, Richard. "Air Carrier Financial Condition: A Review of Discriminant, Logit and Neural Network Models for Measuring the Financial Fitness of the U.S. Airline Industry." K. Button and D. Hensler eds. *Handbook of Transport Strategy, Policy and Institutions*, Vol.VI, 1st ed. (2005): 547-560. Elsevier Press and the World Conference on Transportation Research.

Gritta, Richard. "An Unresolved Issue in Setting the Cost of Capital to the U.S. Domestic Airlines." *Journal of Air Law and Commerce* XL ,(1975): 65-74.

Gritta, Richard, G. Chow, and N. Freed. "Measuring the Degrees of Operating, Financial, and Combined Leverage Facing the U.S. Air Carriers: 1979-1995." *Transportation Law Journal* 26 (1), (1998): 51-71.

Gritta, Richard, S. Davalos, and G. Chow. "Gauging the Financial Condition of the Major U.S. Air Carriers." *Journal of Transportation Law, Logistics and Policy* LXXI (1), (2003): 116-122.

Gritta, Richard, J. Seal, and J.D. Hicks. "Business, Financial and Total Risk in Air Transport: A Comparison to Other Industry Groups Prior to September 11, 2001." *Journal of the Transportation Research Forum*, LVII (4), (2003): 149-156.

Jones, Charles. *Investments: Analysis and Management*. 9 ed. John Wiley & Sons, New York, N.Y. Ch. 6, 2004.

Jung, J.M. and E.T. Fugii. "Price Elasticity of Demand for Air Travel." *Journal of Transport Economics and Policy* (10), (1976): 257-262.

Moyer, Charles, J. McGuigan, and W. Kretlow. *Contemporary Financial Management.* West Publishing Company, St. Paul, Minnesota, 10 ed., Ch. 12 and 13, 2005.

Richard D. Gritta *is professor of finance and transportation at the Robert B. Pamplin Jr., School of Business Administration, University of Portland, Portland, Oregon. He holds the following degrees: BBA, University of Notre Dame, MBA, Indiana University, and Ph.D., University of Maryland. He has published numerous articles in such journals are the Journal of the Transportation Research Forum, Transportation Journal, Logistics and Transportation Review, Credit and Financial Management Review, Financial Management, Handbook of Transport Strategy, Policy and Institution, Journal of Transportation Law, Logistics and Policy, and many others. He is currently associate editor-air transportation for the Journal of the Transportation Research Forum.*

Dr. Bahram Adrangi *is professor of economics at the Robert B. Pamplin Jr., School of Business Administration, University of Portland. He holds the following degrees: BS, University of Tehran, MBA, Western Illinois, and Ph.D., University of Oregon. He has published numerous articles in such journals as the Journal of the Transportation Research Forum, Transportation Journal, Transportation Research: Part E, Journal of Transportation Economics and Policy, Credit and Financial Management Review, Journal of Economics and Business, and many others.*

Dr. Brian Adams *is assistant professor of finance at the Robert B. Pamplin Jr., School of Business Administration, University of Portland. He holds the following degrees: BS, University of Oregon, MBA, University of Portland, and Ph.D., Arizona State University. He has published in the Journal of Foreign Exchange & International Finance and the Indian Journal of Economics and Business and has been an analyst at Wells Fargo Bank.*