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A PECKING ORDER APPROACH TO LEASING: THE AIRLINE INDUSTRY CASE

Suzanne M. Erickson* and Ruben Trevino*

Abstract

This paper investigates the determinants of both short-term and long-term leasing in the airline industry. By examining leasing within a pecking order framework, profitability and growth are introduced as potentially important determinants of leasing. Financial leases are found to substitute for debt and to be used relatively more by firms with higher credit risk. On the other hand, short-term operating leases do not substitute for debt. Operating leases are used by smaller firms, non-tax paying firms and firms experiencing more rapid sales growth. By confining the sample to one industry, asset factors which are potential determinants of lease use can be controlled for.

INTRODUCTION

This paper examines lease use in the airline industry. The purpose is to gain insight into the determinants of leasing and to determine whether leases are substitutes or complements for debt. Capital structure theory has traditionally focused on the optimal levels of debt and equity. Firms trade off the tax benefits of debt for increasing costs of financial distress as debt is added to the capital structure. However, the empirical support for the static trade-off theory has been limited. Profitable firms, with high needs for tax shields and low probabilities of default, have actually been shown to borrow less not more.(e.g. Titman [22], Long and Malitz [11]).

Recently, a more dynamic theory of capital structure has gained renewed interest. Myers and Majluf [17] argue that in the presence of asymmetric information, firm's will follow a "pecking order" in raising funds; financing first with retained earnings, then with debt and with external equity only as a last resort.

The pecking order has received strong empirical support. Baskin [3] and Toy [23] find debt ratios to be positively related to the need for funds (growth) and negatively related to the availability of internally generated funds (profitability).

As yet, a pecking order approach has not been applied to leasing. As a debtlike instrument, leasing is expected to be positively related to growth and negatively related to profitability. Previous empirical studies of the determinants of leasing have omitted profitability and growth from their models, resulting in potentially serious misspecification problems. When the lease choice is framed within the financial pecking order, it is shown that for firms with similar profitability and growth, leases and debt are indeed substitutes.

In this paper, the determinants of short-term operating leases (rentals) are also examined. Most studies have focused on long-term capitalized leases. Recognizing that the motivations for the two may differ, operating leases are not combined with financial leases but are studied separately.

This study extends the previous literature by focusing on a single industry, the airline industry, in an attempt to control for potentially significant asset factors. The airline industry was chosen because the leased assets are homogeneous and because prior studies have shown the airline industry to be significant in cross sectional studies of lease use.

*Seattle University

REVIEW OF THE LITERATURE

Leasing

Traditionally, asset leasing has been considered strictly a function of a firm's tax status (Schall [19], Myers, Dill and Bautista [16], Lewellen, Long and McConnell [9], and Miller and Upton [15]). Firms with low or zero marginal tax brackets were assumed to favor leasing as a method of transferring unusable tax shields to tax paying lessors. Within a given capital structure, leases were assumed to substitute for debt, although the substitution ratio was not agreed upon.

Lewis and Schallheim [10] drop the maintained assumption of these early models, that leases and debt are substitutes, and frame the lease choice within the optimal capital structure choice. They show that leasing can actually increase a firm's debt capacity by selling excess non-debt tax shields. They conclude that leasing and borrowing can be complementary within the firm's optimal capital structure.

Consistent with Lewis and Schallheim's predictions, Ang & Peterson [2] and Finucane [7] find leasing to be positively related to the firm's debt ratio. Marston and Harris [12], on the other hand, find empirical evidence of substitutability between leases and debt by focusing on changes in lease ratios rather than on levels.

Recently, other factors which may be important in the lease decision have been suggested. Ang and Peterson [2], and SJL&M [20] find firm size to be important. Financial health of the lessee has been found to be important by Ang and Peterson, SJL&M and Finucane [8]. Finucane also finds lease use to be negatively related to the lessee's level of subordinated debt.

It is hoped that by framing leasing within the confines of the pecking order, and controlling for several of the factors mentioned above, the issue of substitutability and the role of leasing in financing will be better understood.

The Pecking Order

Myers and Majluf [17] demonstrate that information asymmetries may cause firms to follow a pecking order approach to financing. Due to asymmetries in the information available to managers relative to outsiders, managers may find it optimal to maintain reserve borrowing capacity and avoid external equity markets. Their arguments imply that firms will choose retained earnings before debt and use new stock offerings only as a last resort. The implication of the pecking order for capital structure is that individual capital structures will reflect historical profitability and growth rather than a predetermined optimal mix of debt and equity.

Baskin [3] provides empirical support for the pecking order among a sample of large U.S. firms.[1] He finds debt ratios to be negatively related to profitability and positively related to growth in assets. If historic profitability and growth influence lease use as well, they must be incorporated into the leasing models. The previous leasing literature ignores the effects of profitability and growth on leasing which results in model misspecification and makes significance tests questionable.

THE MODEL

Within the pecking order leasing is predicted to be negatively related to profitability over time and positively related to asset growth as debt is. Although there are no generally accepted models of the determinants of lease use, most researchers agree on the importance of certain factors. One factor is the tax bracket of the lessee. Leasing allows firms with low or zero marginal tax rates to transfer unusable tax shields to tax paying lessors in exchange for lower lease payments. Thus, tax bracket is predicted to be negatively related to leasing.

A more subtle tax effect has been suggested by Erickson [6] and Lewis and Schallheim [10]. For firms with positive tax rates, but high levels of non-debt tax shields (e.g. depreciation and amortization), additional debt may displace existing non-debt tax shields and render them redundant due to statutory limitations on the amount of income that can be sheltered through tax shields. Leasing provides a way to acquire an asset with debt-like financing, while preserving the usability of the firm's existing non-debt tax shields. Thus, firms with high levels of non-debt tax shields are predicted to lease more.

Alternatively, a negative relation is possible for non-debt tax shields when profitability is considered. Following Baskin [3], in the model below profitability is measured as return on assets. However, if firms have high levels of

non-debt tax shields, ROA may be a misleading measure of available cash flows. Other things held constant, firms with high levels of non-debt tax shields will have higher levels of internally generated cash flows and less need to borrow or lease. Thus, leasing will be negatively related to non-debt tax shields.

A factor which both Ang and Peterson [2] and SJL&M [20] find to be important is firm size. Lessor/lenders may choose to reduce the uncertainty surrounding their claims by leasing rather than lending to small firms. Leasing is preferred because the lessor's security is tied to the asset itself rather than to the general credit of the lessee.[2] Thus, other things held constant, smaller firms are predicted to lease relatively more.

Like information, financial health of the lessee is likely to impact the supply of leases versus debt. Finucane [7], Ang and Peterson [2] and SJL&M [20] all suggest that leasing should be negatively related to financial health, although the significance of their findings vary. Since lessors are better protected than lenders in the event of default by the lessee, leasing may be the only way to obtain asset services for firms with a significant probability of experiencing financial distress. Leasing is therefore predicted to be positively related to the lessee's probability of experiencing financial distress.

One factor which may explain the choice between short and long-term leasing is earning variability. For a firm faced with a highly variable expected future cash flow stream, a short-term, cancelable lease may be preferred to a long-term, noncancelable obligation. A positive relation is therefore predicted between earning variability and the use of short-term rentals. Conversely, a negative relation is predicted between long-term leasing and earning variability.

The firm's current debt ratio is included in the model to test for the substitutability of leases for debt. Other things held constant, leasing is predicted to be negatively related to the firm's debt ratio. Finally, the beginning total debt ratio, which includes financial leases, is included to control for historical debt levels. This variable would be unnecessary if the data included a complete history of profitability and growth.

Most empirical leasing models assume linearity. Since there is no compelling evidence to the contrary, a linear specification of the preceding relationships is assumed:

Equation 1

$$LR_i = \underset{}{ß_0} + \underset{-}{ß_1\pi_i} + \underset{+}{ß_2 GROWTH_i} + \underset{-}{ß_3 SIZE_i} + \underset{-}{ß_4 TR_i} + \underset{+}{ß_5 NDTS_i} +$$

$$\underset{-}{ß_6 VAR_i} + \underset{+}{ß_7 PR_i} + \underset{-}{ß_8 DR_i} + \underset{+}{ß_9 BEGDR_i} + e_i$$

where LR_i is the ratio of leases to total assets for firm i, π_i denotes profitability over time, TR_i stands for the lessee's marginal tax rate, $NDTS_i$ denotes non-debt tax shields, VAR_i denotes earnings variability, PR_i represents the lessee's probability of experiencing financial distress, DR_i is the current ratio of debt to assets, $BEGDR_i$ is the ratio of debt plus leases to assets at the beginning of the period and e_i is a normally distributed, mean zero error term. Short-term leases will be analyzed similarly but separately.

THE DATA

Erickson [6] and Finucane [7] find industry to be highly significant in cross sectional regressions of lessee firms. The significance is undoubtedly the result of asset specific factors. Smith and Wakeman [21] and Klein, Crawford and Alchian [8] point to asset specificity, sensitivity to use and maintenance decisions and residual value as being potentially important asset factors in the lease versus buy decision.

The sample used here is drawn from a single industry to control for asset factors. While restricting the sample to a single industry results in relatively small sample sizes, the restriction was necessary to control for the effects of asset specific factors on the lease decision.

The sample was taken from the 1990 Compustat Annual Industrial File, SIC code 4500, Air Transportation. Airlines were chosen because they are consistently heavy users of lease financing and because the assets under lease are homogeneous. The industry includes air freight companies as well as passenger airlines, and small as well as very large companies.

The sample period, 1985 - 1990, encompasses only the period since deregulation. While the post-deregulation shake-out in the airline industry has left airline earnings depressed, the industry is not dissimilar to many other industries reacting to increased international competition or a need for downsizing.

In constructing the sample, firms were deleted if data were missing for any of the variables, or if data was not available for four or six consecutive years, depending on the regression. In addition, the individual variables were screened for outliers and outliers were deleted from the sample.[3]

A summary of mean values over time for key variables is presented in Table 1. Forty three firms had a six year history from which to compute mean values.

From 1985 to 1990 Total Assets and Sales increased steadily, approximately doubling. Over the same period, the Debt/Asset ratio remained relatively constant. On the other hand, the Equity/Asset ratio and the Lease/Asset ratio both declined, which indicates an increased reliance on short-term liabilities. Consistent with this increased reliance on short-term liabilities firms also increased their use of rentals over the sample period.

TABLE 1
History Of Variable Means

N = 43	1990	1989	1988	1987	1986	1985
Assets	2269*	2054	1918	1657	1293	1079
Sales	2347	2176	1865	1507	1347	1222
Debt/Assets	.32	.36	.35	.35	.32	.33
Equity/Asset	.16	.23	.23	.26	.27	.22
Lease/Asset	.076	.076	.086	.085	.090	.098
Rent/Assets	.114	.113	.093	.078	.073	.070
ROA	-.013	.054	.048	.060	.075	.033

*Assets and Sales are in millions.

RESULTS

Debt And The Pecking Order

Baskin [3] uses a cross section of very large firms to test the pecking order theory, by regressing debt to asset ratios on profitability and growth. His findings support the pecking order. Firms with higher profits (high internally generated funds) borrow less while high growth firms (firms with high need for funds) borrow more.

Before presenting the results with leasing, it is interesting to examine the extent to which Baskin's results can be supported in the airline industry. Table 2 contains the results of regressions of debt to asset ratios in the airline industry on measures of profitability, growth, and beginning total debt ratios.

The pecking order predicts that a firm's use of debt will be inversely related to historical profitability. Baskin uses ROAs at time t, t-2 and t-7 to capture the effect of historic profitability on the firm's use of debt. Exact implementation of Baskin's methodology is problematic in this sample, however. In small samples, collinearity between annual ROAs and degrees of freedom are significant concerns. Additionally, the post deregulation shake

out in the airline industry means that very few firms in this sample have a seven year history as independent companies.

TABLE 2
Regressions Of Debt To Asset Ratios

3 YEAR N = 37	CONST	ROA3[a]	GROWA3	GROWS3	TDAR87[b]
(1) $\overline{R}^2$=.30[c]	-.015 (-.132)[d]	.233 (.512)	.122*** (2.682)	-.092** (-2.086)	.649*** (4.023)
5 YEAR N = 30	**CONST**	**ROA5**	**GROWA5**	**GROWS5**	**TDAR85**
(2) $\overline{R}^2$=.36	-.077 (-.710)	.694 (1.06)	.073** (2.201)	-.059* (-1.821)	.723*** (4.193)

a. ROA3 = (ROA89 + ROA88 + ROA87)/3, where ROA = EBIT/TOTAL ASSETS.
b. TDAR87 = TOTAL DEBT/TOTAL ASSETS in 1987.
c. $\overline{R}^2$ are adjusted R^2s.
d. t statistics in parentheses.

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

To deal with these problems average ROA over three and five year periods are substituted for annual ROAs. Two time frames are used because the three year period provides the benefit of a larger sample size, while the five year period provides a longer run framework more consistent with Baskin.

Average ROAs are calculated using average earnings before interest and taxes divided by average total assets. The current period (1990) ROA is not included in the average ROA calculation to avoid injecting spurious correlation into the model.

Recognizing that ROA may not completely capture a firm's internally generated funds, growth in sales was also computed. Sales growth is included to capture increases in revenue and cash flow which are not accompanied by increased profits. GROWS represents growth in sales and is the ratio of ending average sales to beginning average sales. For example, GROWS3, the three year sales growth rate is calculated as:

((SALES90 + SALES89)/2)/((SALES87+SALES86)/2)

and similarly for the five year case.

GROWA is the proxy for growth in assets, and is calculated analogously to GROWS.

The total debt to asset ratio at the beginning of the period is included in the regression to control for the firm's initial level of debt.[4] In effect, this focuses the regression on additions to debt as they relate to growth and profitability over the period of the regression.[5] The beginning total debt ratio reflects differences in historic profitability and growth prior to the sample period.

The results of the debt to asset regressions are presented in Table 2. The coefficients for the average ROAs are insignificant in both regressions. A year by year look at ROAs shows that the airlines have been plagued by fluctuating earnings.[6] Over time, the positive years have been canceled by the negative years making average ROA an insignificant source of funds.

Sales growth, on the other hand, is significant and negative. Consistent with the pecking order, firms with declining revenues were found to borrow more. Finally, growth in assets is positive and significant as predicted by the pecking order.

Overall the regressions for the airline industry in Table 2 are consistent with Baskin's results indicating that airlines, despite their troubles, have tended to follow the prescriptions of the pecking order.

Leasing And The Pecking Order

The determinants of the ratio of leases to total assets are now discussed. Leases includes only those leases reported in the body of the balance sheet.

Three regressions were estimated and the results are shown in Table 3. In the first regression only the "pecking order" variables are included for comparability with Table 2. The independent variables are: average ROA, growth in sales, growth in assets, the current debt ratio and the beginning total debt ratio. The coefficients of average ROA and growth in assets are of the right sign but not significant at conventional levels. Growth in sales is significant and negative as in the debt regressions. Consistent with the predictions of the pecking order, firms with higher sales growth lease less.

Perhaps the most interesting result in equation (1) centers on the debt ratio. Finucane [7] and Ang and Peterson [2] find leasing to be positively related to the firm's debt ratio, concluding that they are complements. The results in Table 3 indicate that leasing is significantly and negatively related to the current debt to asset ratio. In other words, leases and debt are substitutes.

Finally, the coefficient on the beginning total debt ratio is significant and positive. This indicates that firms which have higher starting levels of total debt, continue to use more leasing.

In the second regression, the additional leasing determinants discussed in the previous section are included as independent variables. The addition of these "leasing factors" more than doubles the adjusted R^2 from 0.23 to 0.52.

The coefficient on average ROA remains insignificant and sales growth is still negative and significant as in equation (1). In addition, in this more complete specification of the model, growth in assets becomes significant and positive, as predicted by the pecking order. The current debt ratio remains negative and significant, consistent with the substitutability hypothesis. As in equation (1) the beginning debt ratio is significant and positive.

The firm's Z score is used as a proxy for financial distress.[7] A high Z score indicates a low probability of experiencing financial distress. The Z score was chosen because it is a more comprehensive variable than single ratio measures of liquidity and financial health that have been used previously. The Z score is negative and significantly related to leasing as predicted. Firms in poor financial health lease relatively more.

The ratio of non-debt tax shields to total assets is significant and negative, indicating that firms with high levels of non-debt tax shields actually lease *less*. Since non-debt tax shields are the sum of depreciation, amortization, ITC and tax loss carryforwards,8 firms with high levels of non-debt tax shields will have, other things held constant, higher levels of internally generated cash flows and less need to lease or borrow.

Size, measured as the log of total assets, is negative but not significant at conventional levels. In addition, earning variability and the tax rate are not significantly related to the lease ratio.

The third regression in Table 3 is the same as the second regression except that sales growth, asset growth, and profitability are estimated over five years rather than three. Likewise, the beginning total debt ratio is at the beginning of the five year period.

The results over five years are generally consistent with the three year case although overall significance is reduced. Increasing the sample period to five years reduces the sample size to 25, which in turn reduces the adjusted R^2 (from 0.52 to 0.23) as well as the individual t statistics.

Rents And The Pecking Order

In this section the regression results using the ratio of rents to assets as the dependant variable are discussed. While financial leases and long-term debt represent long-term commitments by the firm, rents represent short-term commitments. Because of this, it is reasonable to expect that the determinants of lease use may differ from the determinants of rents. Most previous studies either ignore rents or combine them with leases. In the regressions the rent ratio is defined as the sum of known rental commitments over the next five years as disclosed in the footnotes to the financial statements, divided by total assets. The results are presented in Table 4.

TABLE 3
Regressions On Lease Ratios

Panel A

3 YEAR	CONST	ROA3	GROWA3	GROWS3	DEBTAR	TDAR87
(1) N=37 $\overline{R}^2$=.23	.106* (1.823)	-.162 (-.674)	.030 (1.139)	-.062*** (-2.491)	-.240*** (-2.589)	.271*** (2.607)
(2) N=32 $\overline{R}^2$=.52	.235** (2.193)	-.088 (-.301)	.074** (2.148)	-.086*** (-3.631)	-.492*** (-3.868)	.367*** (3.549
5 YEAR	**CONST**	**ROA5**	**GROWA5**	**GROWS5**	**DEBTAR**	**TDAR85**
(3) N=25 $\overline{R}^2$=.23	.355** (2.210)	-.326 (-.482)	.037 (1.471)	-.042* (-1.786)	-.422** (-2.357)	.309 (1.702)

Panel B

3 YEAR	SIZE[a]	VAR[b]	TAX[c]	NDTSAR[d]	Z90
(1) N=37 $\overline{R}^2$=.23					
(2) N=32 $\overline{R}^2$=.52	-.009 (-1.249)	.105 (.347)	.054 (1.49)	-.073* (-1.943)	-.043*** (-3.88)
5 YEAR	**SIZE**	**VAR**	**TAX**	**NDTSAR**	**Z90**
(3) N=25 $\overline{R}^2$=.23	-.020 (-1.532)	-.559 (-.91)	.059 (.80)	-.095 (-1.63)	-.040* (-1.82)

a. SIZE = Log of total assets.
b. VAR = Standard deviation of EBIT from 1987 to 1990/average sales.
c. TAX = 1 if the average tax rate > 0, = 0 otherwise.
d. NDTSAR = (Depreciation + Amortization + ITC + Tax Loss Carryforwards) / Total Assets

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

TABLE 4
Regressions On Rent To Asset Ratios

Panel A

3 YEAR	CONST	ROA3	GROWA3	GROWS3	DEBTAR	TDAR87
(1) N=35 $\overline{R}^2$=.15	-.045 (-.132)	-.014 (-0.012)	-.245* (-1.825)	.521*** (3.146)	-.052 (-.114)	.123 (.233)
(2) N=30 $\overline{R}^2$=.56	1.496** (2.568)	-.410 (-.266)	-.258 (-1.511)	.452*** (3.053)	.228 (.355)	.020 (.038)
5 YEAR	**CONST**	**ROA5**	**GROWA5**	**GROWS5**	**DEBTAR**	**TDAR85**
(3) N=24 $\overline{R}^2$=.65	1.644*** (4.044)	.370 (.195)	-.216*** (-3.138)	.240*** (3.856)	.422 (.931)	-.927* (-1.876)

Panel B

3 YEAR	SIZE	VAR	TAX	NDTSAR	Z90
(1) N=35 $\overline{R}^2$=.15					
(2) N=30 $\overline{R}^2$=.56	-.144*** (-4.107)	-3.289** (-2.211)	-.324* (-1.763)	-.465** (-2.434)	.014 (.244)
5 YEAR	**SIZE**	**VAR**	**TAX**	**NDTSAR**	**Z90**
(3) N=24 $\overline{R}^2$=.65	-.097*** (-2.974)	-.202 (-.128)	-.300 (-1.397)	-.297* (-1.923)	-.047 (-.779)

***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

As in the lease case, average ROA is insignificant in the rent regressions. Growth in assets and growth in sales are both significant but the signs are opposite the signs found in the lease regressions. Rentals are negatively associated with asset growth. As the rate of growth in assets reported in the balance sheet declines, rents become relatively more important, perhaps suggesting that firms are substituting off balance sheet financing for debt or leasing. On the other hand, rentals are positively associated with sales growth. This finding may represent the airlines unwillingness to take on long-term financial commitments in the face of highly fluctuating revenues.

There is a significant size effect with rentals that was not evident with leasing. Small firms are making relatively more use of short-term rentals than large firms, supporting the hypothesis that small firms may be perceived as being riskier.

In marked contrast to the lease regressions, the debt ratio is insignificant in influencing the use of short-term rentals. It seems that rentals are neither substitutes nor complements for debt. These results underscore the importance of treating leases and rents separately in empirical tests.

The result regarding earning variability is somewhat puzzling. Earning variability, which was insignificant in the lease regressions, is significant in the decision to rent but the sign is opposite that predicted. Low variability firms actually are renting more of their assets.

The tax variable is negative and significant as predicted. Again, non-debt tax shields are significant and, as with leases, negatively related to the rent ratio. The Z score, which was significant in the lease regressions, is insignificant in the rent regressions.

The five year case is shown in equation (3) of Table 4. The results over five years are generally consistent with the results over three years, although as with leases, the R^2 decreases. Growth in assets is negative and significant and sales growth is positive and significant as predicted by the pecking order. Rents are significantly negatively related to the beginning debt ratio and size of the firm.

CONCLUSIONS

The results of the statistical tests performed here support the pecking order approach to leasing. Leases increase with growth in assets and are inversely related to sales growth. In addition, even though lease ratios are statistically unrelated to profitability, they are related to non-debt tax shields which may proxy for higher cash flows.

An important result of this study is that when profitability and growth are controlled for, lease ratios are inversely related to debt ratios, consistent with the substitutability hypothesis.

In addition, other factors were found to be significant determinants of lease ratios. Faced with a choice between a long-term lease and debt, the results indicate that leasing is preferred by firms for which the probability of financial distress is higher (low Z score). Consistent with other empirical studies, the tax rate itself was found to be insignificant.

On the other hand, the determinants of rentals are found to be different from the determinants of financial leases. These results indicate that in empirical research the two should not be combined.

Rentals were found to be positively related to sales growth, indicating that rentals are supplying off balance sheet financing for firms with growing sales. Unlike leasing, which was found to substitute for debt, rents are not related to the current debt ratio. Furthermore, rents are not associated with poorer credit risks as leases are. However, rentals are negatively related to size, indicating that they may be a more important source of finance for smaller firms.

Contrary to expectations, rents are negatively related to earning variability, high variability firms are actually renting less. Finally, rentals are negatively related to the firm's tax status, providing rare evidence consistent with the often mentioned tax motivation for leasing.

It is clear from the results in Tables 3 and 4 that financial and operating leases are quite different instruments. Previous leasing studies have either combined leases and rents, or ignored rental commitments completely. The results indicate that better insights are gained by treating leases and rents separately.

Previous capital structure studies have used the pecking order approach to further understand the debt versus equity trade-off. These results indicate that the pecking order also applies to leasing. Further research is necessary to see if the results are supported in other industries.

ENDNOTES

1. See Baskin for a review of the pecking order literature.

2. An additional size related factor is access to capital. Small firms may have limited access to capital, or prefer to deploy limited capital in other directions, making leasing a preferred method of asset acquisition. Both size effects indicate that leasing should be negatively related to firm size.

3. Criteria used for deleting outliers for each variable are available from the authors upon request.

4. Total debt is the sum of long-term debt, including financial leases, plus short-term notes and the current portion of long-term debt.

5. Regressions were also run using change in lease ratios, however, since a large number of the changes were small, the results were weaker and are not shown here.

6. In fact, the situation in the airline industry is not so different from the auto industry, the steel industry or any of the other basic U.S. industries faced with modernizing plants in the face of declining demand for their products.

7. See Altman, et. al. [1] for a discussion of the Z score.

8. Mackie-Mason distinguish between investment tax credits, which are tax shields associated with growth, and tax loss carry forwards, tax shields associated with losses. The regressions were run with the tax shields separated by type with no material difference.

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