Further Evidence on the Relationship Between Bankruptcy Costs and Firm Size

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Bankruptcy costs should be higher the greater the complexity of a case; to the extent that firm size is an adequate proxy for complexity, the positive relationship between bankruptcy costs and firm size reported in the literature is expected. A recent study includes the asbestos-related bankruptcy of the Manville Corporation and finds that bankruptcy costs increase with firm size at an increasing rate, suggesting diseconomies of scale, contrary to previous research. We report evidence using an extended data set that suggests that scale economies prevail in bankruptcy costs; the extreme complexity of the Manville case is captured inadequately by the firm's size.

INTRODUCTION

Warner's (1977) well-known study of bankrupt railroads reveals that direct costs of bankruptcy are small relative to firm size and that bankruptcy costs exhibit scale economies; i.e., proportional costs decrease in firm size. Given that bankruptcy cases of large firms tend to be the most complex (and hence the most difficult to resolve), Warner's findings are consistent with rational pricing of services provided in facilitating ownership transfer. Though Warner's sample is small and arguably not representative of the broad set of corporations that experience bankruptcy, the scale effect has been detected in most subsequent studies spanning various types of firms and different time periods. In a recent study of bankruptcy costs, however, Weiss (1990, pp. 289-290) reports that "costs as a percentage of total assets do not decline as the size of the firm increases." Indeed, Weiss (1990) estimates a regression model explaining bankruptcy costs as a function of total assets and the squared value of total assets and finds a significant convex relationship. Weiss suggests that the difference in his findings and Warner's results may be due to the regulated nature of firms in Warner's sample, differences in numbers of debt classes between the two samples, changes in bankruptcy law, or new methods of financing that have developed since the period of Warner's study (1933 to 1955).

Our reexamination of Weiss' data reveals that the scale effect is still a reality in the aftermath of the 1978 act; thus, the contrary findings are not due to changes in bankruptcy law. Instead, Weiss' finding of convexity is due to the presence of a single firm, the

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Manville Corporation, in a data set used to estimate a regression model of bankruptcy costs. Manville is over eight times the average size of the remaining firms in the data set. The size disparity, coupled with the special nature of Manville's bankruptcy costs, causes the observation to exhibit extraordinarily high influence on model parameter estimates such that removal of the observation results in a finding of significant scale economics in bankruptcy costs. Manville declared bankruptcy as a result of extensive tort litigation involving asbestos-related health claims. We argue that the special circumstances facing Manville make it not representative of corporate bankruptcies and that the complexity of this atypical case is not captured well by firm size. Size alone does not serve as an adequate proxy for complexity in this case.

We extend the analysis by including corporate bankruptcies examined by Altman (1984) and Guffey and Moore (1991). For our full sample of 63 firms, we find that the Manville case continues to exhibit extremely high leverage such that its inclusion implies scale diseconomies, while its exclusion results in a finding of scale economies. These findings continue to hold when we restrict the analysis to those firms that filed after the 1978 act and when we control for asset type.

EVIDENCE ON SCALE ECONOMIES IN BANKRUPTCY COSTS

Because direct costs of bankruptcy proceedings must be obtained from various federal bankruptcy courts or regional archives, samples in bankruptcy studies tend to be small. Indirect costs are difficult, if not impossible, to measure.[1] Despite these drawbacks, a pattern emerges when we summarize some of the prominent studies that report direct costs and firm sizes.

Warner (1977) observes in a simple scatter diagram of costs versus firm value that costs increase in size in a concave fashion. He tests for a scale effect by estimating the correlation between the ratio of costs to firm value and total firm value and finds a statistically significant negative correlation estimate. Ang, Chua, and McConnell (1982) estimate logarithmic and quadratic regression equations of costs and asset values; both models support the scale effect, and the quadratic model appears to offer a superior description of the data. Guffey and Moore (1991) test for a scale effect in their sample of trucking firm bankruptcies by estimating the correlation between the ratio of costs to assets and assets. They find a significant negative correlation estimate.

Weiss (1990) presents evidence for 31 firms that filed for bankruptcy from 1980 to 1986 based on a regression model of costs as a quadratic function of asset value. The coefficient estimates do not have the hypothesized signs; thus, he rejects the hypothesis that direct bankruptcy costs are a concave function of firm size. Weiss offers the following interpretation.

[1] Warner (1977) distinguishes direct costs, e.g., legal, administrative and accounting fees, and indirect costs, e.g., erosion of profits due to distraction of management. Altman (1984) estimates indirect costs by comparing profits during bankruptcy with forecast profits based on extrapolation from prebankruptcy data. He finds that indirect costs measured in this way exceed direct costs. Summers and Cutler (1988) estimate the total direct and indirect costs anticipated by the stock market for the 1987 bankruptcy of Texaco. The common stock price reaction to the announcement is implausibly severe (abnormal loss of $1.5 billion).

> From the results of the ordinary-least-squares regressions presented ... the direct costs of bankruptcy appear highly correlated with total assets but do not fit a concave function (i.e., costs as a percentage of total assets do not decline as the size of the firm increases). The difference between Warner's finding and the findings of this study may be explained by noting that Warner's cases are heavily regulated railroads with many more classes of debt than the cases in this study; the changes in the bankruptcy rules and new financing techniques may also play a part. (Weiss, 1990, pp. 289-290)

The possibility that the nature of bankruptcy costs has shifted since the 1978 act such that the scale effect has disappeared is an intriguing one. The data of Ang, Chua, and McConnell (1982) are from 1963 to 1978 (before the Bankruptcy Reform Act of 1978), and they find the scale effect. Thirteen of the 16 trucking firms examined by Guffey and Moore (1991) declared after passage of the 1978 act, however, and their study reveals a significant scale effect as well. Their sample firms were closely regulated by the Interstate Commerce Commission (ICC) during most of the study period, and the regulatory environment was similar to that faced by railroad firms in Warner's (1977) study. Thus, the combined results reported in the studies cited above imply that scale economies disappeared following the 1978 act for unregulated firms, particularly those not regulated by the ICC. This interpretation appears to merit further examination. Our curiosity is elevated by Weiss' (1990) finding of not only the absence of scale economies, but of the presence of scale diseconomics.

REPLICATION AND DIAGNOSIS

CONFIRMING WEISS' RESULTS

Direct bankruptcy costs and book values of total assets are reported by Weiss (1990) for his sample of 31 firms. The dollar amounts for total assets are checked against amounts reported in various editions of *Moody's Industrial Manual* and SEC 10-K forms in files supplied by *Disclosure, Inc.* Table 1 reports the firm names, bankruptcy filing dates (month and year), direct bankruptcy costs (from Weiss, 1990), and total assets determined from the sources above.[2]

We denote total assets by TA, the squared value of TA by TASQ, and direct bankruptcy costs by COSTS in the following linear regression model.

$$(1)\ \mathrm{COSTS}_i = \underset{(1.92)}{\underset{2535.3}{\beta_0}} + \underset{(1.02)}{\underset{5.380\times10^{-3}}{\beta_1}}\,\mathrm{TA}_i + \underset{(4.49)}{\underset{1.143\times10^{-8}}{\beta_2}}\,\mathrm{TASQ}_i$$

Equation (1) is estimated by ordinary least squares (OLS) for the 31 observations in Table 1, with TA and COSTS measured in thousands of dollars. Parameter estimates are beneath

[2] In eight instances our total asset values differ from Weiss' reported values. The reasons for the discrepancies are given in footnotes in Table 1. The discrepancies are minor and have no material effect on the replication results reported next.

Table 1—Bankrupt Firms, Chapter 11 Filing Dates, Direct Bankruptcy Costs, and Total Asset Values for 31 Firms Examined by Weiss (1990)

Firm	Filing Date	Costs	Total Assets
AM International	4/82	$14,765,000	$546,213,000
Anglo Energy	11/83	$9,066,000	$229,596,000
Beker Industries	10/85	$5,042,000	$341,087,000
Berry Ind.	10/84	$620,000	$39,608,000
Bobbie Brooks	1/82	$1,537,000	$87,005,000
Branch Ind.	8/84	$1,229,000	$52,458,000
Brody Seating	2/80	$224,000	$3,986,505[1]
Combustion Equipment	10/80	$2,123,000	$177,991,000
Cook United	10/84	$4,926,000	$166,161,000
Crompton Co.	10/84	$922,000	$97,064,000
Evans Products	3/85	$12,347,000	$803,228,000
Garland Corp.	4/80	$805,000	$25,423,000
Goldblatt Bro.	6/81	$2,736,000	$67,601,000
HRT Ind.	11/83	$6,158,000	$245,740,000[2]
KDT Ind.	8/82	$3,460,000	$239,555,000
Lionel Corp.	2/82	$5,466,000	$221,619,000
Manville Corp.	8/82	$82,475,000	$2,297,814,000[3]
Morton Shoe	1/82	$708,000	$30,818,000
Penn Dixie	4/80	$3,760,000	$176,728,000
Revere Copper & Brass	10/82	$7,560,000	$473,756,000
Richton Inter.	3/80	$1,076,000	$53,477,000
Salant Corp.	2/85	$7,003,000	$110,439,000
Saxon Ind.	4/82	$14,216,000	$486,617,000[4]
Seatrain Line	2/81	$15,422,000	$913,414,000
Shelter Resources	9/82	$2,638,000	$37,728,000
Spencer Co.	11/86	$1,789,000	$34,554,000[5]
Stevcoknit	11/81	$1,279,000	$31,793,000[6]
Tenna Corp.	12/79	$472,000	$29,130,000
Towle Manuf.	3/86	$7,519,000	$239,627,000[7]
White Motor	9/80	$21,168,000	$630,150,000
Wickes Companies	4/82	$20,345,000	$1,552,509,000[8]

[1]Based on SEC Form 10-K, 8/31/79. Weiss (1990) reports $3,823 000 based on Form 10-K, 8/31/78

[2]Weiss (1990) reports $211,146,000 from 1/29/82 financial statements. We use total assets from 1/28/83 financial reports

[3]Weiss (1990) reports $297,814,000; apparent typographical error

[4]Weiss' (1990) amount is from 12/31/80 financial statements. Statements for 1981 apparently were not issued. SEC Form 10-K, dated 9/30/82, reports $486,617,000 for 12/31/81

[5]Our amount is from SEC Form 10-K, 1985. The 1986 financial statements are not available

[6]Weiss (1990) reports amounts as of 1/31/80. We use form 10-K, 1/31/81

[7]Our amount is from Form 10-K, 12/31/84. The 1985 Form 10-K is not available

[8]Weiss (1990) reports $551,509,000; apparent typographical error

the corresponding coefficients and OLS t-statistics are in parentheses.[3] The R^2 value from equation (1) is .90, the same as that reported by Weiss (1990). These results are qualita-

[3] We also estimate equation (1) using heteroscedasticity-consistent variance estimates developed by White (1980). The adjusted t-statistics for the estimates of β_0, β_1, and β_2 are 2.36, .71, and 3.50, respectively. Thus, the finding of concavity is not driven by nonconstant error variances.

tively the same as those of Weiss (1990). His finding of scale diseconomies by regression analysis is confirmed using the corrected values for total assets.

Before turning to our principal method of diagnosis, we present a simple test that suggests the presence of a data problem. If the relation between size (TA) and costs is concave, then the ratio COSTS/TA should be a decreasing function of TA. The estimated linear correlation between TA and COSTS/TA is negative (-.1630), but insignificant (ρ-value = .3811). The Spearman rank correlation estimate is substantially larger in absolute value (-.2940), and significant at the .11 level under the two-sided alternative.[4] Given that the rank correlation estimate is robust to extreme-value observations, the results imply that outliers may account for the different results.

DIAGNOSIS

In this section we report several diagnostic results that will pinpoint a single data point, Manville, that exerts tremendous influence on prediction and parameter estimation of equation (1). Authors of modern regression textbooks often distinguish observations that produce large errors in the y-direction and observations with extreme values in the x-direction. (See Myers (1986), for example.) The former type exhibits substantial vertical distance between the estimated regression surface and the point; i.e., a large ordinary residual. The latter are points that lie far from the mean of the explanatory variables and may exert an abnormally large amount of influence on the regression estimate. Often these same points exhibit small ordinary residuals because they tend to pull the estimated regression surface abnormally close; thus, they are termed *high leverage observations.*

Table 2 presents ordinary residuals (RES) in column 1 and other diagnostic values for the ordinary least squares estimation of equation (1). The largest ordinary residual is -18087.7 for Wickes Companies followed by 10704.5 for White Motor. The residual for Manville is substantially smaller (RES = 7237.9) and thus might not appear to be an extreme observation. Ordinary studentized residuals (SRES) are in column 2 of Table 2. The Manville (SRES = 4.6039), White Motor (SRES = 2.3319), and Wickes Companies data points (SRES = -4.2964) are each over two standard errors from the regression surface. We appeal to the Bonferoni inequality in noting that a significance level (α) of .05 corresponds to an adjusted significance level of α/n = .05/31 = .0016 for this data set. Then, assuming that the error in equation (1) is an identically, independently distributed normal variable, Manville and Wickes are judged outliers.[5]

Detection of outliers in a regression data set is not usually noteworthy because they often have no material effect on estimated parameters. A large error in the y-direction in collaboration with high leverage, however, can exhibit strong influence on prediction and parameter estimation. A commonly used composite measure of influence on the estimated set of coefficients is Cook's D-statistic (Cook, 1977 and 1979), which is reported in column 3 of Table 2. A high value of the D-statistic reveals extreme influence of a given

[4] We thank an anonymous reviewer for suggesting this.

[5] The distribution of SRES is t_{n-p-1}, where n = 31 and p = 3.

Table 2—Ordinary Residuals, Studentized Residuals, Cook's D Statistics, and Covariance Ratios for the Model $COSTS = \beta_0 + \beta_1 TA + \beta_2 TASQ + \varepsilon$

Firm	(1) Residual (× 1000) (RES)	(2) Studentized Residual (SRES)	(3) Cook's D-Statistic	(4) COVRATIO
AM International	5881.5	1.2650	.0561	1.07
Anglo Energy	4693.0	.9779	.0119	1.04
Beker Industries	-657.9	-.1380	.0003	1.17
Berry Ind.	-2146.3	-.4525	.0042	1.16
Bobbie Brooks	-1552.9	-.3253	.0017	1.16
Branch Ind.	-1620.0	-.3409	.0022	1.16
Brody Seating	-2333.0	-.4952	.0063	1.17
Combustion Equipment	-1732.0	-.3608	.0016	1.14
Cook United	1181.2	.2462	.0008	1.15
Crompton Co.	-243.2	-.4694	.0034	1.14
Evans Products	-1882.8	-.4210	.0115	1.31
Garland Corp.	-1874.5	-.3962	.0035	1.17
Goldblatt Bro.	-215.2	-.0452	.0000	1.18
HRT Ind.	1610.5	.3357	.0014	1.14
KDT Ind.	-1019.9	-.2126	.0006	1.15
Lionel Corp.	1177.1	.2452	.0007	1.15
Manville Corp.	7237.9	4.6039	61.2330	.15
Morton Shoe	-2004.0	-.4232	.0039	1.17
Penn Dixie	-83.1	-.0173	.0000	1.16
Revere Copper & Brass	-89.1	-.0190	.0000	1.21
Richton Inter.	-1779.7	-.3744	.0027	1.16
Salant Corp.	3734.1	.7805	.0089	1.09
Saxon Ind.	6356.6	1.3555	.0530	.99
Seatrain Line	-1562.2	-.3545	.0096	1.35
Shelter Resources	-116.6	-.0246	.0000	1.19
Spencer Co.	-945.9	-.1996	.0000	1.18
Stevcoknit	-1438.9	-.3038	.0020	1.18
Tenna Corp.	-2229.7	-.4710	.0049	1.16
Towle Manuf.	3038.3	.6332	.0051	1.11
White Motor	10704.5	2.3319	.2426	.66
Wickes Companies	-18087.7	-4.2964	2.1418	.06

observation on model estimation.[6] The massive effect of Manville on the full set of three coefficient estimates is clear from Table 2. For Manville, Cook's D = 61.233 compared to the next larger value of 2.1418 for Wickes. The Manville case is the only observation that is rejected under the Bonferoni inequality ($F(p,n-p) = F(3,28) = 61.233$ is significant at the .00001 level).

A single inverse measure of precision of a set of parameter estimates is the generalized variance, i.e., the determinant of the variance-covariance matrix for the coefficient estimates. A diagnostic device, denoted as COVRATIO, is a ratio with the generalized variance for the full data set in the denominator and the generalized variance with the ith observation deleted in the numerator. A small value of COVRATIO implies that a given observation increases the generalized variance or decreases the precision of an estimator.

[6] Cook's D is distributed approximately as F with p numerator degrees of freedom and n p denominator degrees of freedom. The numerator and denominator of Cook's D are chi-squared random variables, but they are not independent. Cook's D is said to be "F-like" by Myers (1986).

Column (4) of Table 2 presents COVRATIO for each observation. It is clear that Manville (COVRATIO = .15) and Wickes (COVRATIO = .06) cause substantial deterioration in the precision of the coefficient estimates.[7]

There are a few observations in the data set that exert strong influence on point estimates of coefficients, precision of those estimates, or both. The central issue is whether any of these observations is sufficient to produce a positive and significant estimate for β_2, the coefficient for TASQ. To focus on this question we estimate the regression coefficients for the data set with each observation deleted in turn. The result is termed the *empirical influence function*.[8] We report the estimated values for β_1 and β_2 in Table 3, along with OLS t-statistics and R^2 for each version.

Table 3—Empirical Influence Function for the Model $COSTS = \beta_0 + \beta_1 TA + \beta_2 TASQ + \varepsilon$ (Estimated coefficients from data examined by Weiss, 1990)

Firm	b_1	(t-statistic)	$b_2 \times 10^{-8}$	(t-statistic)	R^2
AM International	0.0036	(0.67)	1.224	(4.72)	.9057
Anglo Energy	0.0052	(0.99)	1.155	(4.53)	.9040
Beker Industries	0.0055	(1.01)	1.138	(4.36)	.9005
Berry Ind.	0.0050	(0.93)	1.157	(4.45)	.9005
Bobbie Brooks	0.0052	(0.97)	1.149	(4.43)	.9003
Branch Ind.	0.0051	(0.95)	1.152	(4.43)	.9003
Brody Seating	0.0049	(0.90)	1.163	(4.45)	.9005
Combustion Equipment	0.0054	(1.00)	1.142	(4.42)	.9005
Cook United	0.0054	(1.01)	1.143	(4.41)	.9007
Crompton Co.	0.0052	(0.96)	1.151	(4.45)	.9006
Evans Products	0.0063	(1.09)	1.106	(4.04)	.9010
Garland Corp.	0.0050	(0.93)	1.157	(4.43)	.9003
Goldblatt Bro.	0.0054	(0.99)	1.144	(4.39)	.9002
HRT Ind.	0.0053	(0.99)	1.148	(4.43)	.9010
KDT Ind.	0.0054	(1.01)	1.140	(4.40)	.9004
Lionel Corp.	0.0054	(1.00)	1.145	(4.42)	.9007
Manville Corp.	0.0280	(7.74)	-0.982	(-3.71)	.8460
Morton Shoe	0.0050	(0.93)	1.157	(4.44)	.9004
Penn Dixie	0.0054	(1.00)	1.143	(4.41)	.9003
Revere Copper & Brass	0.0054	(0.99)	1.142	(4.31)	.9006
Richton Inter.	0.0051	(0.95)	1.153	(4.44)	.9003
Salant Corp.	0.0057	(1.07)	1.132	(4.41)	.9028
Saxon Ind.	0.0038	(0.71)	1.218	(4.75)	.9067
Seatrain Line	0.0062	(1.06)	1.110	(4.03)	.9003
Shelter Resources	0.0054	(0.99)	1.144	(4.38)	.9001
Spencer Co.	0.0052	(0.96)	1.149	(4.40)	.9001
Steveoknit	0.0051	(0.94)	1.153	(4.42)	.9002
Tenna Corp.	0.0050	(0.92)	1.159	(4.45)	.9005
Towle Manuf.	0.0053	(0.99)	1.152	(4.47)	.9021
White Motor	0.0016	(0.31)	1.315	(5.43)	.9179
Wickes Companies	0.0133	(4.01)	0.944	(6.14)	.9654

[7] A precise yardstick for judging whether COVRATIO is low is difficult to determine. Belsley, Kuh, and Welsch (1980) recommend the cutoff of 1 – 3p/n. In this case, 1 – (3p/n) = 1 – (3(3)/31) = .71. According to this yardstick, Manville, Wickes, and White Motor have high influence on generalized variance.

[8] See Andrews, Bickel, Hampel, Huber, Rogers, and Tukey (1972), Hampel (1974), and Hinkley (1977) for discussion of the influence function and its properties. See Cook and Weisberg (1980) for discussion of some useful modifications.

The results in Table 3 pinpoint Manville as the only data point that, when excluded, leads to a negative estimate of β_2 (-.982), the coefficient for TASQ. While some data points represent outliers and some have strong influence on estimator precision, Manville is the only observation that results in a convex relationship between firm size and bankruptcy costs. The model estimated with Manville deleted is shown in equation (2).

$$\text{(2) COSTS} = \underset{(0.16)}{113.267} + \underset{(7.74)}{.028}\ \text{TA}_i - \underset{(-3.71)}{.982 \times 10^{-8}}\ \text{TASQ}_i$$

The R^2 value for equation (2) is .8460. From equation (2) it is clear that costs are increasing in total assets at a decreasing rate.[9]

Influence diagnostics produced for equation (2) show Wickes is the sole high influence data point (Cook's D-statistic = 3.4939, significant at the .03 level). Removal of Wickes, however, does not alter the conclusion of concavity. The 29 remaining observations yield t-statistics for estimates of β_1 and β_2 of 5.14 and -2.07, respectively.[10]

ANALYSIS OF AN EXPANDED DATA SET

Before presenting a brief argument for deleting Manville on theoretical grounds, we examine a data set that includes Weiss' (1990) 31 observations, the 16 trucking firm observations used by Guffey and Moore (1991), and 16 retail and industrial firms examined by Altman (1984).[11] With all 63 observations (Manville included) the estimated model is reported in equation (3).

$$\text{(3) COSTS} = \underset{(2.62)}{1882.65} + \underset{(0.00)}{8.27 \times 10^{-6}}\ \text{TA} + \underset{(6.80)}{1.35 \times 10^{-8}}\ \text{TASQ}.$$

The coefficient estimates indicate convexity and the R^2 value is .8386. The result is driven exclusively by Manville. Cook's D-statistic for Manville is 85.271, by far the highest of the 63 observations (the next highest is .9235). With Manville deleted, the model estimated over 62 observations is reported in equation (4).

$$\text{(4) COSTS} = \underset{(.98)}{485.99} + \underset{(6.54)}{.023}\ \text{TA} - \underset{(-3.21)}{9.15 \times 10^{-9}}.$$

Thus, the concave relation holds in the expanded data set when Manville is removed.[12]

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[9] White's (1980) adjusted t-statistics for b_1 and b_2 in equation (2) are 6.04 and -3.48, respectively.

[10] White's (1980) adjusted t-statistics are 5.18 and -2.42 for estimates of β_1 and β_2.

[11] The book value of total assets for each of Altman's (1984) firms is obtained from *Moody's Industrial Manual, Moody's OTC Industrial Manual,* and *Disclosure, Inc.* Book value information for three firms could not be found reducing the Altman (1984) sample from 19 to 16 firms.

[12] White's (1980) t-statistics for estimates of β_1 and β_2 are 4.09 and -1.87, respectively.

Of the 63 observations, 44 firms declared bankruptcy after 1978, including Manville. In equation (5) we report the estimated model for all 44 firms. In equation (6) we report the model for this subset minus Manville.

$$(5)\ \text{COSTS} = \underset{(1.85)}{1512.48} + \underset{(2.09)}{.0083}\ \text{TA} + \underset{(5.10)}{1.02 \times 10^{-8}}\ \text{TASQ}$$

$$(6)\ \text{COSTS} = \underset{(.38)}{158.71} + \underset{(10.69)}{.028}\ \text{TA} - \underset{(-4.86)}{9.19 \times 10^{-9}}\ \text{TASQ}.$$

The function after 1978 continues to exhibit concavity when Manville is removed (equation (6)) and convexity when Manville is included (equation (5)). Thus, the finding of convexity by Weiss (1990) is evidently not due to a change in the bankruptcy laws, but rather to the inclusion of Manville in the data set.

The extreme influence of Manville could be due to misspecification of the model. Firm size is not a universally good proxy for case complexity or for costs of resolution. Thus, despite high R^2 values, the model most likely suffers from omitted variables. Theoretical arguments justify asset type as a natural component of a bankruptcy cost function, and we have a convenient (albeit coarse) measure of asset type in industry classification. We add two indicator variables to the model for firms in trucking and retailing; as expected, the cost function differs significantly according to the classification. Trucking firms and retailers tend to have lower costs of bankruptcy, evidently due to the nature of their assets, i.e., their cases may be less complex. The strong influence of Manville still is exhibited, however, even with this improved specification. When Manville is included, we find convexity. When it is deleted, we find concavity.[13] Thus, the complexity of the case is not captured by firm size and asset type.

Finally, we note that the Spearman rank correlation between COSTS and COSTS/TA is negative (-.2857) and significant at the .025 level when Manville is included. With Manville omitted, the rank correlation estimate is -.2999, significant at the .02 level. Thus, this simple and straightforward test reliably detects the presence of scale economies.

CONCLUSIONS

The special nature of Manville's liability exposure affected the bankruptcy proceedings (and hence bankruptcy costs) in at least two ways. First, the substantial uncertainties about the firm's ultimate liability likely delayed management's development of a reorganization plan. Second, the asbestos litigation affected the proceedings because asbestos litigation claimants became creditors of the firm for purposes of liquidation of the firm's assets. In Manville's second amended plan of reorganization, classes of claimants were grouped in order of priority into nine classes. Classes 3 and 4, both asbestos-related claims categories, were deemed impaired; thus, they were required to approve the plan.

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[13] We thank a reviewer for recommending the improved specification. Estimation results are available from the authors.

The point is that costs of asbestos litigation became intertwined with costs of bankruptcy; therefore, Manville's huge bankruptcy costs are not representative of other firms in the Weiss (1990) sample or our expanded sample, and the complex nature of the case is not gauged accurately by the firm's size or our coarse indicator of asset type. Manville is the only observation whose inclusion in the data set leads to a finding of convexity.

The time in bankruptcy and therefore the costs involved likely were influenced significantly by the identification of asbestos-related tort claimants as creditors in the bankruptcy process. It does not appear possible to estimate reliably what Manville's direct bankruptcy costs would have been had the tort claimants not been named as creditors.

Manville's special and extremely complex circumstances render it not representative of firms that undergo bankruptcy due to operating losses. We therefore argue that the conclusion that scale economies have disappeared since passage of the 1978 act is not warranted, as that conclusion is based exclusively on the inclusion of one not representative firm in the set of observations.

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