A Study on the Measurement and Prediction of The Indirect Costs of Bankruptcy

The Leonard N. Stern School of Business
Glucksman Institute for Research in Securities Markets
Faculty Advisor: Kose John
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By Stephen E. Cays

I. Introduction

This paper seeks to identify the significance of, and the potential causes of the so-called "indirect" costs of bankruptcy. These costs include such factors as lost sales from falling demand as a result of customer concerns over future service difficulties, declining margins resulting from increased input costs from suppliers, loss of key personnel, and loss of management time and effort. Naturally, such costs are difficult to measure and, consequently, there is a dearth of information on their potential magnitude. However, it is generally believed that these indirect costs can be substantially higher than the more easily observed "direct" costs of bankruptcy. Direct costs include items such as legal, accounting, and other professional fees, reorganization costs, etc. and have been found to fall between 4% and 10% of firm value three years prior to bankruptcy. [1,5] In this paper, I extend the measurement methodology devised by Altman for indirect costs beyond the retail and industrial sectors to include consumer brands, energy, financial, technology, transportation, and utilities. By taking a cross-section of firms from diverse industries, an attempt is made to isolate industry characteristics that lead to higher/lower indirect costs among industries. This study does not treat each industry exhaustively (e.g., sample sizes within each industry are small). Rather, it is intended to highlight possible areas of further research, and to support the research results achieved to date on the issue of the significance of indirect bankruptcy costs.

II. Methodology

The method used to measure indirect bankruptcy costs was developed by Altman [1], and involves the measurement of lost profits as a result of financial distress. A firm's sales are first regressed to those of the industry in which it operates for the ten years prior to the measurement period. Industry sales are based on the sales generated by the ten largest companies in the firm's industry. The regression formula obtained from this process is then used to predict sales going

forward for the company, based on the actual sales generated by the industry. After the firm's sales are forecast for the measurement period, the average net profit margin over the prior ten years is applied to arrive at an estimated profit for each year leading up to the firm's bankruptcy filing. This profit estimation is then compared to the firm's actual profit for that period, and the difference is considered to be the indirect cost of bankruptcy. These costs are measured for the year of the bankruptcy, and two years prior.

III. Firm Sample

Table 1 lists the firms included in this study, the industry each firm represents, and the month and year of the firm's bankruptcy filing. Firms were selected from the past decade for timeliness, and selections were limited to those firms that had been operating for at least thirteen years prior to filing. Where possible, multiple firms were included in an industry.

Table 1

Industry	Company	Date of Bankruptcy Filing
Capital Goods	Apogee	March 1998
	Armstrong	December 2000
	Harnischfeger	June 1998
	Owens Corning	October 1998
	USG Corp	March 1993
Consumer Cyclicals	Emerson Electronics	October 1993
	Fruit of the Loom	December 1999
	Zenith Electronics	December 1998
Energy	Presidio Oil	March 1995
Financial	ICH Corp	October 1995
Specialty Retail	Levitz Furniture	September 1997
	Service Merchandise	March 1999
Technology	Anacomp	January 1996
	Wang Labs	August 1992
Transportation	Builder's Transport	March 1998
Utilities	El Paso Electric	January 1992

III. Critiques of the Measurement Method

In his discussion of the regression technique, Altman notes that it is difficult to isolate indirect bankruptcy costs. The firm might be experiencing an unexpected reduction in profits

from the specter of bankruptcy, while at the same time the unexpected reduction in profits may lead the firm to declare bankruptcy. It is possible that factors completely unrelated to bankruptcy drain the firm's expected profits, and may push the firm into bankruptcy quickly, limiting or eliminating altogether the costs sought in this method. Another problem is determining the point at which indirect costs begin to accrue. For example, in the cases of Owens Corning and Armstrong, the firms were pushed into bankruptcy when management determined that asbestos-related lawsuits would continue to grow beyond the firms' capacity to meet them. This possibility must have been foreseeable by both customers and suppliers as early as 1982 when Manville declared bankruptcy for the same reason. In these cases, the ten-year measurement period might be applied too late, effectively forecasting earnings with indirect costs already removed.

Haugen and Senbet [3] raised another argument, which posits that Altman's measure confuses the costs of liquidation with the costs of bankruptcy, and further states that the measure exaggerates the liquidation costs. This argument is an extension of the causal problem listed earlier, but seems to miss an important point. A firm experiencing indirect bankruptcy costs need not declare bankruptcy. In the event that bankruptcy is avoided, the costs are nevertheless borne from financial distress, and should not be ignored. The argument appears to be one of semantics, which stresses that bankruptcy is merely the transfer of ownership from stockholders to bondholders, rather than the cost of dismantling the assets of the firm upon liquidation. Stakeholders, then, have no reason to assume that bondholders would run the firm any less efficiently than stockholders. They argue further that pointing to firms that were in distress and assuming the distress is what caused a fall in demand is a leap of faith. An identical *unlevered* firm may have suffered the same decrease in product demand. However, if an industry-wide downturn had occurred along with that faced by the firm, it would appear in the measure of

industry sales, and the firm's expected profits would be adjusted to reflect it. Therefore this problem, while valid, appears to have been solved in Altman's method.

IV. Regression Results

Table 2 lists the results for the first portion of the measurement, sales predictions. In the majority of cases the regressions on firm sales with industry sales over the selected ten-year period were good (12 out of 16 $R^2 > 50\%$), while many were excellent (6 out of 16 $R^2 > 80\%$).

Table 2.

Industry	Company	Sales Regression R^2	Industry Average R^2
Capital Goods	Apogee	57.7%	43.84%
	Armstrong	4.3%	
	Harnischfeger	56.7%	
	Owens Corning	61.8%	
	USG Corp	38.7%	
Consumer Cyclicals	Emerson Electronics	98.7%	79.77%
	Fruit of the Loom	96.1%	
	Zenith Electronics	44.5%	
Energy	Presidio Oil	55.7%	55.7%
Financial	ICH Corp	34.8%	34.8%
Specialty Retail	Levitz Furniture	76.7%	85.1%
	Service Merchandise	93.4%	
Technology	Anacomp	88.6%	84.4%
	Wang Labs	80.2%	
Transportation	Builder's Transport	92.0%	92.0%
Utilities	El Paso Electric	62.3%	62.3%

It is interesting to note that almost none of the variability in Armstrong's sales is explained by overall industry sales, while Owens Corning, a very similar firm in terms of size, product, reason for distress, and timing of bankruptcy filing has a much higher R^2. The reason for this anomaly is unclear, but it highlights the complexities associated with these measurements.

The results suggest that sales predictions will be most reliable for consumer cyclicals, specialty retail, technology, transportation, and, to a lesser extent, utilities and energy. Applying the average net margin over the ten-year sales regression period to predicted sales for each of the two years preceding bankruptcy (t-2, t-1) and to the year of the bankruptcy filing (t),

we get the estimated absolute indirect costs of bankruptcy. Table 3 lists these estimates (IBC), as well as estimated firm value (FV) in each year, and bankruptcy costs as a percentage of firm value. Firm value was estimated by adding to the year-end market value of equity all book values of long-term debt and capitalized leases.

Table 3.

Company	IBC (t-2) ($mil)	IBC (t-1) ($mil)	IBC (t) ($mil)	FV (t-2) ($mil)	FV (t-1) ($mil)	FV (t) ($mil)	IBC/ FV (t-2) (%)	IBC/ FV (t-1) (%)	IBC/ FV (t) (%)
Capital Goods									
Apogee	(10.1)	71.7	0.7	683.5	479.7	477.2	(1.5)	15.0	0.2
Armstrong	108.9	81.2	66.6	4,351.3	3,090.6	1,604.3	2.5	2.6	4.1
Harnischfeger	(78.3)	(101.6)	56.9	2,998.0	2,600.6	1,585.5	(2.6)	(3.9)	3.4
Owens Corning	704.5	(270.6)	362.5	3,744.3	2,684.3	2,067.2	18.8	(10.1)	17.5
USG Corp	276.6	312.9	474.1	2,750.6	2,742.3	1,491.1	10.0	11.4	31.8
Averages							**5.5**	**3.0**	**11.5**
Consumer Cyclicals									
Emerson Electronics	44.4	41.7	39.6	13,657.6	13,320.8	15,250.4	0.3	0.3	0.3
Fruit of the Loom	600.2	(21.1)	699.1	3,669.7	2,608.6	2,166.1	16.4	(0.8)	32.3
Zenith Electronics	137.1	260.7	240.9	1,071.2	694.3	458.9	12.8	37.6	52.5
Averages							**9.8**	**12.4**	**28.3**
Energy									
Presidio Oil	3.2	20.5	23.2	348.8	312.0	246.9	**0.9**	**6.6**	**9.4**
Financial									
ICH Corp	(139.5)	418.9	256.3	663.1	690.5	420.9	**(21.0)**	**60.7**	**60.9**
Specialty Retail									
Levitz Furniture	29.6	33.9	101	644.2	965.3	733.5	4.6	3.5	13.8
Service Merchandise	169.9	193.4	340.1	1,065.5	970.8	909.6	16.0	19.9	37.4
Averages							**10.3**	**11.7**	**25.6**
Technology									
Anacomp	(54.0)	(55.1)	189.2	657.2	559.2	421.0	(8.2)	(9.9)	44.4
Wang Labs	842.7	524.1	502.3	1,472.9	1,446.2	1,030.4	57.2	36.2	48.8
Averages							**24.5**	**13.2**	**46.9**
Transportation									
Builder's Transport	9.9	17.8	53.3	433.3	412.6	361.1	**2.3**	**4.3**	**14.8**
Utilities									
El Paso Electric	196.0	117.2	654.4	1,246.7	1,199.4	1,561.9	**15.7**	**9.8**	**41.9**
AVERAGE							**7.8**	**11.5**	**25.8**

Negative numbers depict years in which the firm earned profits in excess of those forecast for that year, implying a benefit from financial distress. This occurred eight times in the sample, out of 48 observations, or 12.5% of the time. However, it should be noted that the magnitude of

these counterintuitive results are far smaller than their normal counterparts in most cases (the exception being Harnischfeger). Overall, the results suggest, as predicted, that in each industry there are costs associated with financial distress, and they normally escalate as a percentage of firm value as bankruptcy nears. Based on these results, it is difficult to say that any meaningful comparison can be made among industries. Even an intra-industry comparison of composite firms shows a great deal of variability each year among firms. Variability notwithstanding, it is clear that these costs are not trivial in the aggregate, and should not be ignored by firms in their selection of an optimal capital structure.

V. Comparison of Results to Original Study

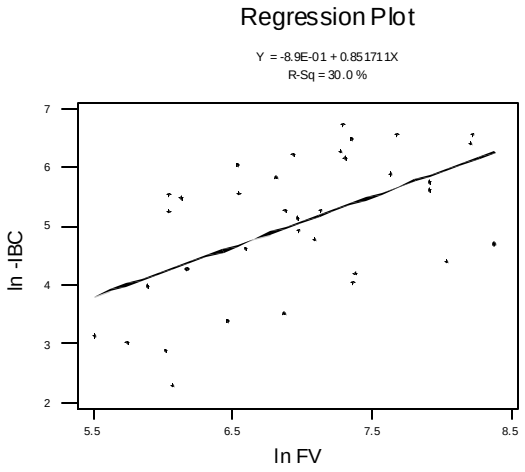
Altman's study focused on two industries, retail and industrial. For the sample of firms in both industries (N=18), the average ratio of indirect bankruptcy costs to firm value was calculated to be 7.1% in year t-2. This is fairly close to the results obtained in the current study, where the average ratio in year t-2 was calculated to be 7.8%. In year t-1, Altman's average ratio drops to 6.6%, while the ratio calculated herein rises to 11.5%. Finally, in the last year, t, Altman's average rises to 10.5% compared to 25.8% in my sample. One reason for the difference may be Altman's inclusion of operating leases in the calculation of firm value. As the firm nears bankruptcy, these leases may play a larger role in firm value, which would adjust my ratios upward with respect to Altman's. The present results are consistent with Warner's [5], who found that firm values fall consistently as bankruptcy approaches.

VI. Other Applications

Having obtained estimates of indirect bankruptcy costs for a sample of sixteen firms across eight industries, it is now possible to examine some of the hypotheses put forth regarding the nature of these costs and the factors determining their magnitude. A study conducted by David Flath and Charles Knoeber [2] found that by comparing Warner's direct bankruptcy costs

to the estimated total failure costs obtained in their study, indirect costs were likely to be substantial, and highly correlated to firm size. By regressing the log of estimated bankruptcy costs to the log of firm value, I found that indirect costs are positively correlated to firm size, although there are clearly other factors at play. Figure 1 shows a plot of the log of indirect bankruptcy costs to the log of firm size, with a fitted regression line.

Figure 1.



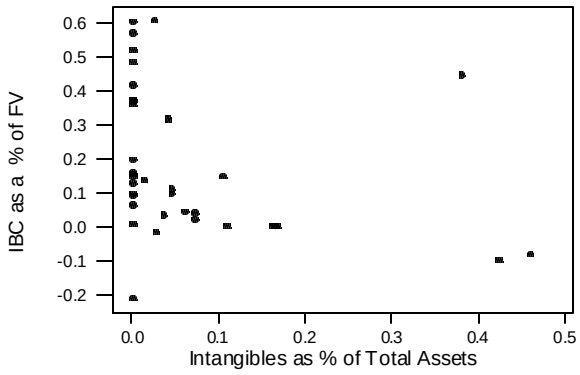
The R^2 of 30% highlights the limited ability of firm size to explain the variations in the size of indirect bankruptcy costs. However, the graph supports the results obtained by Flath and Knoeber. Substituting other proxies for firm size, such as sales or total assets, yielded very similar results. Therefore, it appears that indirect bankruptcy costs are positively correlated to firm size.

The more interesting question is whether or not there is a variable or set of variables that can explain how indirect bankruptcy costs are determined from firm to firm. For example, what accounts for the stability of Emerson Electronics' IBC/FV ratio over the three-year estimation period, relative to the quadrupling of the same ratio over the period for Zenith Electronics? Moreover, Zenith's total indirect bankruptcy costs substantially exceed those of Emerson for

each of the three years, despite Emerson's dominance over Zenith in terms of firm value. This strange result seems to support Haugen and Senbets' criticisms of the present method. They argue that if markets are rational and make unbiased forecasts, Altman's measure merely captures a forecasting error that may have nothing to do with bankruptcy.

Setting such arguments aside for the moment, I conducted a series of tests on the current sample, designed to locate the main factor or factors that determine how these estimated costs are realized. Assuming that indirect bankruptcy costs are, in fact, costs arising from the fear of liquidation, I tested the levels of intangible assets as a percentage of total assets and as a percentage of firm value against the observed cost estimates. The theory here is that, in liquidation, intangible assets will have little or no value as compared to tangible assets. Therefore, indirect bankruptcy costs as a percentage of firm value should be higher in firms whose asset structure is heavily weighted by intangibles. Figure 2 shows the plot of indirect bankruptcy costs over firm value compared to tangible assets over total assets.

Figure 2.

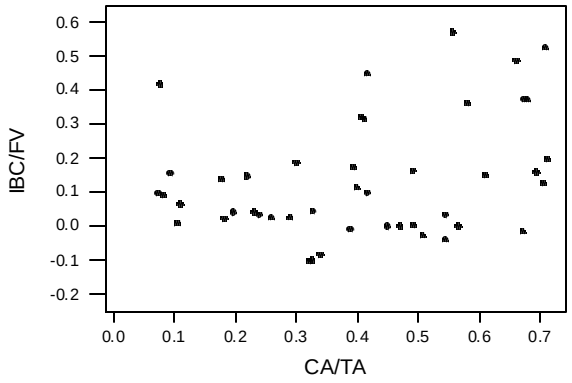


It is clearly illustrated that for this sample, indirect bankruptcy costs had little to do with the proportion of intangible assets to total assets. The large portion of the sample that had no

intangible assets shows a wide range of IBC/FV outcomes, and for those firms that have intangibles on the balance sheet, no real pattern is discernible in the plot.

Another interesting idea was summarized by John [4], which states that there is a positive relationship between corporate liquidity and the costs of financial distress. To test this hypothesis on the current firm sample, I used the current ratios as the measure of liquidity, and regressed them against their respective IBC/FV ratios. Figure 3 shows the result.

Figure 3.



As the plot shows, the result is fairly random. However, there is a slight positive slope of 0.28 to the regression, with an R^2 of 10%. This seems to support the argument, as firms whose IBC/FV ratios are high seem to be slightly favoring more liquid asset structures.

The final test applied to this data set was designed to focus on the supplier reaction to a firm's financial distress. If relationships are strained by financial distress, which generally result in a higher cost of inputs to the distressed firm, we should see a decline in gross margins as suppliers raise prices, remove discounts, demand better terms, etc. To test this, the average gross profit margin was measured for the ten-year sales regression period. Then the gross profit margin achieved in each of the next three years was compared to this average. Table 4 displays

the results of this test. Years in which the gross margins improved relative to the ten-year average are highlighted in gray. The number reported is the percentage change in the gross profit margin from the calculated average.

Table 4.

Company	% Change in Gross Margins (t-2)	% Change in Gross Margins (t-1)	% Change in Gross Margins (t)
Capital Goods			
Apogee	(13.80)	0.75	23.90
Armstrong	16.95	11.93	(0.97)
Harnischfeger	14.31	14.01	(44.65)
Owens Corning	(10.73)	(9.12)	(16.82)
USG Corp	(7.44)	(16.48)	(21.42)
Averages	**(0.14)**	**0.22**	**(11.99)**
Consumer Cyclicals			
Emerson Electronics	3.77	2.33	5.58
Fruit of the Loom	(6.80)	(17.02)	(16.99)
Zenith Electronics	(36.34)	(43.90)	(44.31)
Averages	**(13.12)**	**(19.53)**	**(18.59)**
Energy			
Presidio Oil	**(27.62)**	**1.71**	**(1.35)**
Financial			
ICH Corp	**(127.72)**	**(10.31)**	**(237.37)**
Specialty Retail			
Levitz Furniture	(6.68)	(8.34)	(11.27)
Service Merchandise	(0.04)	(4.02)	(1.69)
Averages	**(3.36)**	**(6.18)**	**(6.48)**
Technology			
Anacomp	11.30	4.41	(5.64)
Wang Labs	(5.53)	(5.65)	(13.60)
Averages	**2.88**	**(0.62)**	**(9.62)**
Transportation			
Builder's Transport	**(6.63)**	**(44.52)**	**(64.90)**
Utilities			
El Paso Electric	**(31.70)**	**(43.73)**	**(38.35)**
AVERAGE	**(14.67)**	**(10.50)**	**(30.62)**

Although the sample shows high variability with respect to this measure, in the aggregate it does appear that there is a substantial change downward in gross margins as the firm nears bankruptcy. These results suggest that those firms that can find ways to appease their suppliers stand to avoid a lot of the costs associated with financial distress. Of the eight occurrences in which indirect bankruptcy costs were calculated to be negative, half are associated with periods

of rising gross margins above the ten-year average. The average of IBC/FV in year (t) for those firms experiencing higher than average gross margins in year (t) was just 0.25%, compared to the average of 25.8% in that year overall. The average of IBC/FV in year (t-1) for those firms experiencing higher than average gross margins in that year were 1.8%, compared to 11.5% overall. Finally, the average of IBC/FV in year (t-2) for those firms experiencing higher than average gross margins in that year were –2%, compared to 7.8% overall.

VII. Conclusion

Using the lost profits methodology developed by Altman, an analysis was conducted on the estimated indirect bankruptcy costs observed across industries. In the aggregate these costs were found to be quite high with respect to firm value, and the results support previous assertions made by academics as to the significance of these indirect costs on optimizing capital structures. While there is still no easy way to predict the magnitude of these costs for a given firm, a positive correlation was found between firm size and the magnitude of indirect bankruptcy costs. No correlation was found to exist between the ratio of intangible assets over total assets and the ratio of indirect bankruptcy costs over firm value. A slight positive correlation was found between current ratios and the IBC/FV ratio, suggesting that those firms experiencing high financial distress costs will tend to move toward a more liquid asset structure. Finally, gross margin trends were tested, and verified that the cost of inputs rises as a result of financial distress. Those firms managing to maintain a slight improvement over average gross margins in any given year experienced dramatically reduced indirect costs of bankruptcy over the sample as a whole.

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