

Market Valuation of Bankrupt Firms: Is There An Anomaly?

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Several recent articles in the popular press have focused on the market valuation of bankrupt stocks. The apparently unrealistically high positive prices have been pointed out as an indication of potential pricing inefficiency in the market. Such an inference may or may not be warranted if we regard a bankrupt firm's equity as a deep out-of-the-money call option. This study investigates these issues by examining the evidence on the post-bankruptcy behavior of common stocks for a sample of 154 firms. First, we present evidence on the wealth effects of bankruptcy filing on the pre-petition stockholders. The results show that the pre-petition stockholders, on average, lost about 70 percent of their value during the bankruptcy period. Second, we examine whether the market valuation of bankrupt stocks is realistic using the Black-Scholes option pricing model. We find that bankrupt stock prices may be realistic for some estimated levels of the Black-Scholes parameters but not for others.

Introduction

While regarded as a period of significant economic growth and business expansion, the 1980s also experienced an unparalleled rate of bankruptcy filing. Corporate bankruptcy continues to be the subject of extensive theoretical and empirical investigation because of its implications for the pricing of a firm's securities and the determination of a firm's optimum capital structure.

Not surprisingly, a firm's bankruptcy announcement is accompanied by an intensely adverse market reaction toward its stock (e.g., Aharony, Charles, and Swary,

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1980; Clark and Weinstein, 1983; Lang and Stulz, 1992). Several studies have examined the wealth effects in the days surrounding the bankruptcy announcement. None of these studies, however, systematically has examined the post-bankruptcy filing behavior of the firm's equity securities. In many instances the shares of bankrupt companies remained actively traded on organized exchanges although they frequently turned out to be worthless. Not infrequently, the proposed reorganization plans provided no consideration (or, at best, only token consideration) for the pre-bankruptcy filing equity holders. Nonetheless, the shares continued to trade for nontrivial prices. For example, after it filed for bankruptcy, the stock of LTV, the nation's second largest steel producer, continued to trade on the New York Stock Exchange at a price above \$1 per share even though the value of the company's assets was significantly lower than the creditor's claims. The popular press has pointed to these apparently unrealistically high positive prices as an indication of potential pricing inefficiency in the stock market. If we regard equity of a bankrupt firm as a deep out-of-the-money call option, however, equity should have a positive value. Accordingly, the positive market prices obtained may or may not be realistic.

This study investigates the evidence on the post-bankruptcy behavior of common stocks for a sample of 154 firms that filed for bankruptcy between 1984:1 and 1993:12. First, we present evidence on the wealth effects of bankruptcy filing on the pre-petition stockholders. The results show that, on average, the original stockholders' stocks lost about 70 percent of their value during the bankruptcy period. The common stockholders of 93 bankrupt firms received no consideration at the end of the bankruptcy. Second, we examine whether the market valuation of bankrupt stocks is realistic using the Black-Scholes option pricing model. Several of the parameters needed to apply the Black-Scholes model, however, are not directly observable. When we estimate these parameters (strike price, volatility, length) in different ways we get different results. For some levels of the parameters the theoretical price is substantially above the actual price. For other levels the theoretical price is at or below the market level.

Prior Research

The current bankruptcy law is governed by the Bankruptcy Reform Act of 1978 (as amended). Under the current act, firms can file for either reorganization (Chapter 11) or liquidation (Chapter 7). Chapter 11 of the Bankruptcy Act provides protection while a financially distressed firm attempts to formulate a repayment plan and re-emerge as a viable reorganized concern.

Information Effects of Bankruptcy Announcement

The usefulness of investor information is the key issue addressed in information content studies. The usefulness or relevance of information is often judged by the level of market activity associated with a particular event. The efficient market hypothesis (EMH) has been the predominant paradigm for much of the empirical work in the areas

of financial economics and macroeconomics. EMH (in its various forms) maintains that the capital markets are able to reflect all (or some significant subset) of available information quickly and accurately. Therefore, the prices of investment assets at any time reflect the rational expectations of investors. We have been surfeited with writings on stock market efficiency (or lack of it). Most of the relevant evidence seems to support the proposition that the stock market is relatively efficient in assessing the value of a company (Fama, 1970; Fama, 1991).

The announcement of a bankruptcy filing also should be associated with market activity. Such an announcement (particularly if it is not fully anticipated) provides material information about the reduction in the value of the firm. At a minimum, a firm must pay substantial legal and other costs of bankruptcy administration. Furthermore, deteriorating business conditions usually precede the actual bankruptcy. Accordingly, markets normally would have started to react before the actual announcement. The filing itself, however, eliminates any question of whether the firm could implement an out-of-court settlement.

Several researchers have examined the impact of bankruptcy filings on the behavior of the firm's common stock on and around the announcement date. Aharony, Jones, and Swary (1980) who analyze the risk and return characteristics of 45 industrial firms that declared bankruptcy from 1970 to 1978 provide some of the earliest evidence. They find that the cumulative differential portfolio return turns negative approximately 4.5 years before bankruptcy and declines increasingly thereafter. The authors report a sharp decline in the return seven weeks before the actual filing, implying that the market did not fully anticipate the filing even a few weeks before the event. The changes in risk were determined by examining the shift in the variance for the bankrupt group and the control group using cross-sectional and time-series analysis. They find a significant increase in the total variance of the bankrupt firms with the approach of the bankruptcy date. They find no significant difference in the systematic risk for the two groups, however. Clark and Weinstein (1983) report similar results for a much larger sample of stocks of 148 bankrupt firms from 1938 to 1979. They find that the abnormal return is approximately -30 percent in the month of bankruptcy filing. An examination of the three-day return interval (-1, 0, 1) around the announcement date shows a cumulative return of -47 percent. Such a decline in stock price could be attributed to reduction in the call option value of equity resulting from the impending direct and indirect cost of the bankruptcy process. Morse and Shaw (1988) analyze the investment characteristics of 56 firms that filed for bankruptcy between 1973 and 1982. Consistent with prior research findings, they also find that the bankruptcy filing is associated with a significant increase in variance, while systematic risk is not affected. Further, the stock prices are observed to react favorably to both the announcement of the reorganization plan's filing and to the creditors' approval of the plan. The filing of the plan was associated with an increase in the value of the stock of 8 percent, while the approval of the plan was accompanied by a 10.7 percent return.

More recently, Lang and Stulz (1992) examine the impact of a bankruptcy announcement on other firms in the industry. They examine two intra-industry effects: the contagion effect and the competitive effect.¹ Lang and Stulz find that the value-weighted portfolio of common stock of the competitors fell 1 percent. Further, the effects were found to be greater (-3.2 percent) for a subsample consisting of industries that were highly leveraged and faced a high degree of competition, while the effects were significantly positive (2.2 percent) for industries with low leverage and a lower degree of competition. This study also corroborates the previous findings of significant negative abnormal returns around the days surrounding the bankruptcy announcement. Lang and Stulz find an average loss of 28.5 percent for bankrupt firms from five days before to five days after the announcement.

Overall, these studies indicate that both the announcement of bankruptcy and the anticipation of an announcement are accompanied by significant market activity. Stock prices tend to decline around the bankruptcy announcement date. Further, the market is able to distinguish firms that emerge successfully from the process from firms that do not. Moreover, bankruptcy announcements have important wealth implications for other firms in the same industry.

Market Valuation of Bankrupt Stocks

The evidence discussed in the previous sections (which admittedly only deals with some aspects of the relevant issues) is largely consistent with the efficient market hypothesis. Accurate estimation of the intrinsic value of securities lies at the core of an efficient securities market. The value of a security can be regarded as the present value of all of its expected future cash flows. Stocks of bankrupt companies would be considered to be accurately valued if the prices appropriately reflect all available information that could potentially influence the future cash flows to security holders. One critical issue is whether the stock market accurately values the securities at all times. Several researchers have investigated this question in the distressed securities market.

Fridson and Cherry (1990) analyze the initial prices of 113 high-yield bonds (issued in 1985) to determine whether the market is able to accurately predict those bonds that would eventually default. They conclude that the market had accurately priced the bonds because the majority of issues that defaulted had significantly large

¹ Lang and Stulz define the *contagion effect* as “the wealth loss experienced by firms with cash flows similar to those of the bankrupt firm because the bankruptcy announcement conveys information about the present value of cash flows for these firms.” The *competitive effect* is defined as “the wealth gain experienced by the competitors because the bankruptcy announcement conveys information about the present and future competitive positions of firms in the bankrupt firm’s industry.” They use the Herfindahl index as a proxy for the degree of market power. This index is measured as the sum of the squares of the fraction of industry sales held by the nonbankrupt firms.

spreads over government Treasury bonds. Buell (1992) extends their analysis to cover 638 high-yield bonds issued between 1977 and 1989 and reaches similar conclusions.

Eberhart and Sweeney (1992) test the informational efficiency of the bankrupt bond market using a price unbiasedness test for a sample of 136 bonds representing 59 firms. The price unbiasedness test measures whether the post-announcement price of a bond is an unbiased estimate of the final settlement price.² They observe the average announcement month price to be \$384.10 with a standard deviation of \$237.15. The results, in general, are consistent with market efficiency. They do find several cases where the results are inconsistent with market efficiency.

Altman and Eberhart (1994) conduct two tests of the efficiency of the market for defaulted bonds.³ The first test examines whether the different categories of bonds are efficient on the default date. Their results are mixed. They find that the *mean excess returns* are negative and significant, indicating systematic overpricing during the default period. But the *median excess returns* are not highly significant.⁴ They argue that median excess returns provide a better representation of market behavior as it circumvents the problem of outliers in mean excess returns. Returns are bounded by -100 percent on the downside but unbounded on the upside. Thus a median excess returns number may be a biased representation of what a diversified portfolio would produce. The second test examines the efficiency of bond prices at issuance by comparing the issuance price and the post-bankruptcy payoff to individual bondholders. Not surprisingly, they find that the losses to bondholders are inversely related to their seniority.⁵ They interpret this (indirect) evidence as suggesting that bond markets are efficient.

Evidence in support of pricing efficiency is also provided by Ma and Weed (1986). They investigate the pricing efficiency of high-yield bonds by comparing the yield to maturity of high-yield bonds issued for takeover purposes with other high-yield bonds. They report that while the average yield on takeover bonds is lower than the other

² The price is adjusted for time value of money, risk, and market movements.

³ Their sample consists of 232 bonds of 91 firms that filed for and emerged from bankruptcy between 1980 and 1992.

⁴ They report the mean (median) excess return for the whole sample of 202 issues to be -1.29 (.14). The mean (median) excess returns for different categories of bonds were as follows: secured bonds = 1.23 (-1.14); senior bonds = .60 (1.07); senior-subordinated bonds = -1.88 (-2.41); subordinated (cash-pay) = -3.95 (-1.40); subordinated (non-cash-pay) = 4.34 (1.85).

⁵ They report the mean (median) loss for the overall sample of 232 issues to be -48.38 (-65.60). The mean (median) losses for different categories of bonds are as follows: secured bonds = 1.68 (-.75); senior bonds = -22.05 (12.59); senior-subordinated = -75.13 (-86.04); subordinated (cash-pay) = -70.58 (-79.57); and subordinated (non-cash-pay) = -90.38 (-91.38).

The loss is measured as being equal to [price or payoff at emergence - price at issue]/price at issue.

group of bonds, the difference is not statistically significant.⁶ Weinstein (1987) in his analysis of fallen angels from 1962 to 1974 concludes that low grade bonds are fairly priced. Blume, Keim, and Patel (1991) and Cornell and Green (1991) also observe that low grade bonds are efficiently priced.

While the academic literature (most of which relates to bond pricing) largely suggests that distressed securities are efficiently priced, the popular press has frequently conjectured that stock pricing *may be* inefficient during the bankruptcy period.⁷ Terms such as 'foolish,' "naïve," and "irrational" have been used to describe investors in bankrupt firms in publications including the *Wall Street Journal* and the *New York Times*.⁸ As an example of pricing inefficiency, the shares of Continental Airlines continued to trade on the AMEX at or about \$1.50 per share even after the company had negotiated a plan with its creditors that would provide no distribution to the pre-petition stockholders (*WSJ*, 1992).⁹ Such anomalous pricing (if it exists) has significant implications for different players in the securities market and for the efficient allocation of resources. We explore whether such pricing behavior may be evidence of market inefficiency or whether the positive market price of bankrupt stocks (despite the negative net worth of the company) may reflect the option value imbedded in any bankrupt firm.

Chambers and Lacey (1994) suggest that equity could be viewed as a call option when the probability of bankruptcy is high. Because equity holders have a residual interest in the firm, their value equals the difference between the market value of the

⁶ The mean (S.D.) yield for takeover bonds is 15.93 (1.73) as compared to 16.39 (2.09) for other bonds. The sample consists of 47 takeover bonds and 47 matching junk bonds issued between March 1980 and September 1985.

⁷ To quote two prominent vulture investors:

- George Putnam of New Generation Research (*WSJ*, 1993): "Clearly, the bankrupt security market is not efficient. But that's why we like it;"
 - George Soros of Quantum Fund (*Hedge*, 1994): "In certain circumstances, financial markets can affect the so-called fundamentals which they are supposed to reflect. When that happens, markets enter into a state of dynamic disequilibrium, and behave quite differently from what would be considered normal by the theory of efficient markets."
- ⁸ *New York Times*, September 16, 1993, p. 8: "Pros are selling the company's virtually worthless stock to foolish retail investors..."
- *Wall Street Journal*, February 9, 1993, p. C1: "Stocks of companies operating under Chapter 11 of the bankruptcy laws ... have been trading lately at prices that market veterans say are irrationally high ... much of the speculative activity comes from naïve investors."
 - *Boston Sunday Globe*, August 3, 1997, p. E3: "Discovery Zone emerged from bankruptcy protection on July 29. Although the company announced the cancellation of its outstanding common stock, investors continued to trade the shares ... The SEC stepped in to stop trading because people might not realize that the stock they were buying was worthless, ... Discovery Zone ... also issued two press releases that said the shares had been cancelled ..."

⁹ Another case in point is the common stock of LTV, which continued to trade on NYSE at \$2 a share, which was more than 60 times the value provided for the shares in the reorganization plan.

assets and the liabilities. Thus, if the value of the assets exceeds the value of the debt claims, the shareholders will exercise their option by causing their company to continue to service the debt. On the other hand, if the value of assets were lower than the value of debt, the shareholders would eventually be forced to allow their firm to declare bankruptcy and let the option expire. Thus, the positive value of bankrupt stocks reflects the premium for time, i.e., the possibility that the value of the firm will exceed the value of its debt before the maturity/payment date of the outstanding debt. Hence, we need to determine the value of bankrupt stocks using an option valuation framework before any inference can be drawn about the efficiency of the market in pricing such stocks. The current study is designed to examine the evidence on the price behavior of common stocks of firms filing for bankruptcy under Chapter 11.

Data and Research Methodology

Sample Selection

A list of firms filing for Chapter 11 was identified from the *Wall Street Journal Index* and Moody's CD-ROM business database for the period January 1984 to December 1993. The dates when the reorganization plans were filed and confirmed were compiled in a similar manner. Only firms that were listed on the NYSE, AMEX, or NASDAQ National Market System were considered for this study. Financial institutions were excluded because they are not subject to the same conditions under the Bankruptcy Code. A total of 299 Chapter 11 filings were identified for the period. One hundred and sixteen firms were eliminated, as they could not be contacted or had insufficient trading history. Eight firms were deleted as they were still in Chapter 11. An additional 21 firms were dropped as they were privately held. Of the remaining 154 firms considered for this study, 49 firms were, at the time that they filed for bankruptcy, listed on NYSE, 32 on AMEX, and 73 on NASDAQ. Most of the relevant data were not available on the standard data tapes. We wrote and called the successor corporations and their professionals to obtain copies of the reorganization plans.

Return to the Pre-Petition Stockholders

The value of the final distribution to the stockholders was compiled from a variety of sources, including reorganization plans, annual reports, press releases, and direct interviews with the firm's legal and/or investor relations department. Pre-petition stockholders are compensated according to the terms provided in the confirmed reorganization plan. If the plan provides any consideration, they are usually issued a combination of equity and/or warrants in the reorganized company. Seldom is any cash distributed to stockholders. An accurate assessment of the value of the final distribution would require information on the (a) type and amount of securities received and (b) the market value of these securities on the emergence date. This information is not available

in the reorganization plans and other public documents and hence had to be obtained directly from the companies.¹⁰

We computed the percentage holding period return to the stockholders as follows:

$$\text{Return percent} = [\text{Ending Value} - \text{Beginning Value}] / \text{Beginning Value}$$

where:

$$\begin{aligned} \text{Ending Value} &= \text{Distribution (per share) made to stockholders;} \\ &= [\# \text{ of shares received} * \text{price of share on issue (effective date)} + \# \text{ of} \\ &\quad \text{warrants received} * \text{value of warrant on effective date} + \text{cash}]; \end{aligned}$$

Beginning Value = Stock price on the date of bankruptcy filing.

If the pre-petition stockholders retained their stock, the ending value would be the market price on the emergence date.

Valuing Bankrupt Stocks as a Call Option

As discussed in the previous section, the bankrupt firm's stockholders may be regarded as holding a call option on the firm. Because no dividends are paid during the bankruptcy period, holding the bankrupt stock is equivalent to holding an American call option on a non-dividend-paying stock. Furthermore, as American call options should never be exercised early (in the absence of dividends), the Black-Scholes option pricing formula for an European option gives the value of an American call option on a non-dividend-paying stock. Thus, the Black-Scholes option pricing model for European options will be appropriate for valuing the stocks of these bankrupt firms.

The value of a call option, C , is

$$C = SN(d_1) - Xe^{-rT}N(d_2)$$

where:

$$\begin{aligned} d_1 &= [\ln(S/X) + (r + .5\sigma^2)t] / \sigma\sqrt{T} \\ d_2 &= d_1 - \sigma\sqrt{T} \end{aligned}$$

The variables in the model are defined as follows:

- C = The value of the call option;
- C = The market value of equity on the day of filing;
- S = The value of the firm's assets on the day of filing;
- X = The book value of total liabilities on the day of filing;
- T = Time from filing Chapter 11 to emergence from Chapter 11; or
- T = 120 days from filing Chapter 11 (period of exclusivity);
- r = The annualized T-bill rate in the month of filing;
- σ = The annualized standard deviation of returns of the stock in the year prior to filing.

¹⁰ For example, the reorganization plan for American Healthcare states: "The holder of common stock will receive new shares of the company and warrants to purchase shares of common stock of the company. Each claimant shall receive on the effective date a pro rata distribution of 51,705,723 shares of new common stock." To obtain the market value of distribution, one needs to know the number of new shares received for each old share as well as the initial trading price of this new common stock.

The annualized standard deviation of the firm is proxied by the standard deviation of the returns on common equity. While the Black-Scholes model requires the annualized standard deviation of returns, it may be more relevant to base the standard deviation on more recent returns. Accordingly, we calculate standard deviation of returns based on daily returns over periods of one year, three months, and two weeks prior to filing and annualize. Of the possible 252, 63, and ten trading days in these three estimation periods, we require a minimum of 232, 55, and nine trading days, respectively. We also stipulate that a firm's stock trade for nine of the ten trading days following the Chapter 11 filing. This results in a sample of 39 firms. The market value of equity on the date of bankruptcy filing is retrieved from the Center for Research in Securities Prices (CRSP) file. Balance sheet data are obtained from SEC publications of public companies filing for Chapter 11.¹¹ Interest rates are obtained from *Moody's Municipal and Government Manual*.

Basing our volatility estimate on historical data may produce an upward bias. A now bankrupt company's share price will almost always have fallen dramatically as it approaches a bankruptcy filing. Accordingly, the pre-filing price history will have incorporated a great deal of downward volatility. For that history to be an accurate guide to the future, the shares would need to be equally likely to rise by the same percentage as they have fallen or to fall that same percentage again. Our results suggest that stock price rises are much less likely than such continuing price falls for the shares of bankrupt firms. Accordingly our historical volatility estimates are likely to be upwardly biased. Such upwardly biased volatility estimates will lead to upward biased estimates for option values.

Discussion of the Results

In this section we first present descriptive data on the bankrupt firms. We then report evidence on the final distribution made to the pre-petition shareholders and the option values for the bankrupt stocks on the bankruptcy filing dates.

Descriptive Statistics

We identify a total of 299 bankruptcy announcements during the period January 1984 to December 1993. The final sample consists of 154 firms. Such survivorship problems are not unusual in bankruptcy studies.¹² Those cases where data are available

¹¹ In four cases, these figures were not found in the SEC data; hence, we obtained them from the Compustat quarterly database for the quarter ending prior to the bankruptcy filing date.

¹² For example, in the study by Clark and Weinstein (1983), the number of observations in the daily data dropped from 106 on 220 days before the filing to 12 on the actual event date. For monthly data, the sample is similarly reduced—from 36 observations for 36 months before the event date to 19 on the actual event date.

Table 1—Time Spent in Bankruptcy

Number of calendar days between filing for Chapter 11 and approval of reorganization plan by the court			
Time Spent	N	Mean	S.D.
Less than 100 Days	6	51.5	11.49
100 to 250 Days	15	183.4	50.89
251 to 500 Days	46	374.04	81.31
501 to 750 Days	34	629.21	68.90
751 to 1000 Days	22	890.68	74.46
More than 1000 Days	13	1377.61	430.61
Total	136	583.64	376.83

are probably the ones where the ultimate recovery for the claimants tends to be greater. For example, many of the missing cases may have been converted to Chapter 7 (and their assets liquidated) where the absolute priority principle applies and shareholder recoveries are rare. Thus, to the extent that our sample is biased by our selection criteria (we could only select those cases for which sufficient data are available), that bias may enhance the possibility of finding favorable results for the claimants. That we nonetheless find poor average recoveries for shareholders implies that had we had the benefit of a complete data set, the results would probably have been more negative for the shareholders.

Table 1 documents the time spent in reorganization. An average 583 days (or about 19 months) elapsed between filing for Chapter 11 and approval of the reorganization plan by the court.¹³ The total time spent varied significantly among the firms, ranging from a low of 35 days (Gaylord Container) to a high of 2506 days (LTV). The results are consistent with Hotchkiss (1995) who finds the average time for completed bankruptcy reorganizations to be 19.5 months.

Table 2 presents the closing price of 109 common stocks on the bankruptcy filing date.¹⁴ The stocks of about 72 percent of the firms had prices under \$2 per share at the time of filing. Only about 14 percent of the firms had prices greater than \$5. The average price was \$2.86.

Several firms were delisted on or immediately after/prior to filing for bankruptcy. Only 33 firms continued to trade on their pre-listing exchange while undergoing reorganization. Further, 15 firms were delisted voluntarily from their respective exchanges. Eight firms started trading on other exchanges after delisting.¹⁵ Because listing requirements for various exchanges are governed largely by financial considerations, such mass delisting could be interpreted as a sign of deteriorating

¹³ This is based on a reduced sample of 136 firms, as we did not have complete information for 18 firms.

¹⁴ The price information was primarily retrieved from the CRSP tapes. In a few cases, the prices were obtained directly from the company and stockbrokers. Despite our best attempts, we could not obtain the prices of 45 firms.

¹⁵ Upon delisting, the firms were either moved from NYSE to AMEX/OTC or from AMEX to OTC.

Table 2—Bankrupt Stock Prices

Closing stock price of 109 firms on the day of Chapter 11 filing

Price Range	N
Less than \$1	56
\$1 < P < \$2	23
\$2 < P < \$5	15
\$5 < P < \$10	8
\$10 < P < \$15	2
Greater than \$15	5
Mean	\$2.86
Standard Deviation	\$7.12

financial conditions. These findings are consistent with Bradley and Rosenzweig's (1992) observations. They examine the timing of delisting of bankrupt firms originally listed on NYSE or AMEX. They report the number of bankrupt firms listed on the exchange dropped from 117 (a week before bankruptcy filing) to 64 (two weeks after filing). Further, 46 firms were delisted during the two year period preceding the bankruptcy petition date.

Frequently, the reorganized firms emerged without any debt in the capital structure. The old debtholders usually received most of the equity in the reorganized firm leading to a change in ownership from old stockholders to the pre-petition creditors. For example, when American Healthcare emerged from bankruptcy, 93 percent of the company's new common stock was issued to the pre-petition creditors, which resulted in a change in control.

Return to Pre-Petition Shareholders

The Chapter 11 process is consummated with the approval of the reorganization plan by the court and distribution of assets to various claimants.¹⁶ In this section, we focus exclusively on the distribution made to pre-petition stockholders.¹⁷

Table 3 shows the return to pre-petition stockholders of the 154 firms. The pre-petition stockholders usually received nothing or a small amount of new common stock and/or warrants to purchase additional shares in the reorganized firm. In 15 cases the

¹⁶ The final plan confirmed usually involves liquidation or reorganization of the firm. A third alternative, acquisitions by healthier firms, also has become increasingly popular. For example, A.H. Robins which filed for bankruptcy in 1985 was acquired by American Home Products in 1989 for about \$3 billion in common stock plus a \$2.3 billion contribution to meet product liability suits.

Hotchkiss (1992) in her comprehensive analysis of 1096 public firms that filed for bankruptcy between 1979 and 1990 found that 284 firms emerged as public companies, 199 firms emerged as private companies, 164 firms were liquidated, and 72 firms were either merged or acquired. The remaining 413 firms were either still in reorganization or no further information was available (as quoted in Altman, 1993).

¹⁷ Equity holders rank lowest in the order of priority at the time of distribution. Thus, any violation of absolute priority rule would tend to work in their favor.

Table 3—Return to Pre-Petition Stockholders

Sample of Firms	N	Mean Return*	S.D.
All Firms	154	-69.77 percent	74.17
Firms with Positive Return	14	114.59 percent	125.16
Firms with Negative Return**	140	-88.20 percent	23.24
Firms with Negative Return (Excluding -100% Return Firms)	44	-69.29 percent	23.18
Firms with Zero Recovery	93	-100 percent	0

* The mean return represents the return for the period in bankruptcy and not annualized returns

** Includes three firms with zero return

stockholders retained their old common stock. The interests of the pre-petition stockholders, however were almost always significantly diluted by the issuance of common stock to satisfy the claims of various groups of creditors (often accompanied with reverse stock splits). For example, in Munsingwear, the stockholders received one new share in exchange for 25 old shares held. The shares of Munsingwear were selling for 93.75 cents at the time of bankruptcy filing. Thus, the new shares would have to trade at \$23.4375 to correspond to the pre-split level. The new stock, however, started trading at just \$6.125. Occasionally reorganization involves partial liquidation. For example, Todd Shipyards closed two of the four shipyards as part of the reorganization process. Table 3 reveals that the old common stocks, on average, lost about 70 percent of their value during the bankruptcy period. If we exclude the 14 firms with positive returns, the average loss increases to nearly 90 percent. Stockholders of 93 firms (from our sample of 154) received nothing.

The consistently negative holding period return across a broad sample of stocks stretching over a ten year period raises some interesting questions: Why do investors invest in a security with a negative expected return? Are investors consistently overpricing the stock? Does such seemingly anomalous pricing behavior have a rational explanation?

One possible explanation could be that the low priced stocks of bankrupt firms are attractive investments to risk-preferring investors who may view investment in these stocks similar to buying lottery tickets. For example, in our sample, in 14 cases an investor could have made a significant return (average return = 114.59 percent) by buying stock after the bankruptcy filing. Also, the returns on bankrupt stocks were characterized by high positive skewness (4.09).

One also could argue that such pricing reflects the embedded options in bankrupt stocks.¹⁸ We believe that computing the values of these stocks using the Black-Scholes option pricing model would permit us to draw a more realistic conclusion about the market valuation of bankrupt firms.

¹⁸ There were no options traded on any of the 39 stocks at the time of bankruptcy filing.

Table 4—Descriptive Statistics for the Sample of 39 Firms

Time spent in Chapter 11 is the number of calendar days between filing for Chapter 11 and approval of a reorganization plan by the court. Price range includes the closing stock price on the day of Chapter 11 filing. BV Assets and BV Liabs represent book value of assets and liabilities, respectively, and the figures are in millions. Annualized standard deviation of returns and daily trading volume are based on daily returns and daily trading volumes over periods of one year, three months, or two weeks prior to filing and two weeks post filing

Panel A

Time Spent in Chapter 11	N	Price Range (P)	N
Less than 100 Days	3	Less than \$1	17
100 to 250 Days	3	\$1 < P < \$2	14
251 to 500 Days	9	\$2 < P < \$5	7
501 to 750 Days	11	\$5 < P < \$10	1
751 to 1000 Days	7	\$10 < P < \$15	0
More than 1000 Days	6	Greater than \$15	0
Mean	643	Mean	\$1.44
Standard Deviation	377	Standard Deviation	\$1.11

Panel B

	BV Assets	BV Liabs
Mean	\$634	\$666
Standard Deviation	\$594	\$687

Panel C

Annualized Std Dev of Return	1Y PRE	3M PRE	2W PRE	2W POST
Mean	1.136	1.572	2.067	2.027
Median	1.038	1.512	1.799	1.745
Daily Trading Volume (1000s)				
Mean	91725	104288	157778	187150
Median	55688	47305	53400	114433

Valuation of Bankrupt Stocks Using the Black-Scholes Option Pricing Model

The Black-Scholes option pricing model (BS-OPM) analysis is based on a sample of 39 firms. These firms were selected according to the criteria discussed in the methodology section. The descriptive statistics for this sample of firms (Table 4) is similar to that of the larger sample (Tables 1 and 2). We calculate the prices of 39 bankrupt stocks using the Black-Scholes option pricing model. The BS-OPM estimated prices of the stocks (hereafter referred to as the BSE) are compared to their market prices at the close of trading on the bankruptcy filing date. These results are displayed in Table 5. In general, most estimates are higher than actual prices and the differences are statistically significant.

Different estimates result when different times to maturity (TTM) are used or when standard deviations are calculated from different time periods. Panels A and B (Table 5) use standard deviations of returns calculated from one year of daily returns. In Table 5, Panel A's results (BSE median = \$9.19, actual price median = \$1.13) are based on

Table 5—Valuation of 39 Bankrupt Firms

Valuation of stocks of 39 bankrupt firms on the day of filing for Chapter 11 using Black-Scholes option pricing model (BS-OPM). The filings occurred from 1986-1993. Actual price is the closing price of the firm's stock on the day of filing for bankruptcy. BSE is the value of the stock estimated using the BS-OPM. Difference is calculated as the difference between BSE and actual price for each firm. For some firms, the estimate (BSE) is less than the closing price, making the difference a negative value. Hence the minimum value for all firms under the difference column will be negative. Summary statistics are provided for the 39 estimates, the 39 closing prices, and the 39 differences. T-statistics are reported for the probability that the difference in mean prices (BSE and actual) is equal to zero, with p-values in parentheses

	BSE	Actual Price	Difference	t-statistic (p-val)
Panel A: TTM = Time Spent in Ch. 11		Annualized σ Based on One Year of Daily Returns		
Mean	\$13.74	\$ 1.44	\$12.29	5.60 (< .01)
Median	9.19	1.13	8.50	
Max.	56.56	5.75	53.68	
Min.	0.02	0.09	-1.35	
S.D.	14.27	1.11	13.70	
Panel B: TTM = 120 Days		Annualized σ Based on One Year of Daily Returns		
Mean	\$ 9.28	\$ 1.44	\$ 7.84	6.33 (< .01)
Median	8.17	1.13	7.48	
Max.	30.16	5.75	25.24	
Min.	0.00	0.09	-1.59	
S.D.	8.36	1.11	7.73	
Panel C: TTM = 120 Days		Annualized σ Based on Three Months of Daily Returns		
Mean	\$12.16	\$ 1.44	\$10.72	6.50 (< .01)
Median	10.62	1.13	9.36	
Max.	46.83	5.75	43.96	
Min.	0.00	0.09	-1.38	
S.D.	10.87	1.11	7.40	
Panel D: TTM = 120 Days		Annualized σ Based on Two Weeks of Daily Returns		
Mean	\$14.83	\$ 1.44	\$13.38	5.07 (< .01)
Median	8.60	1.13	7.72	
Max.	88.07	5.75	85.19	
Min.	0.00	0.09	-1.88	
S.D.	17.03	1.11	16.48	

TTM equivalent to time spent in Chapter 11. Panel B's results (BSE median = \$8.17, actual price median = \$1.13) are based on TTM equivalent to the period of exclusivity. This is the 120-day period immediately following the filing when only the debtor in possession has the right to propose a reorganization plan. This period might be considered a reasonable holding period during which the firm might be rescued with value left for the shareholders. If the firm remains longer in bankruptcy, it may be an indication of more serious problems, with little hope of recovery for shareholders. Accordingly, the remainder of the analysis is based on the assumption of TTM of 120 days.

Previous research has found that the variance of returns increases significantly as a firm approaches bankruptcy. To check the sensitivity of our estimates to changes in

volatility, we recalculate them for volatility measured over different periods. In particular, we calculate the annualized standard deviation based on three months of daily returns and two weeks of daily returns. The results, reported in Table 5 (Panels C and D), show increased values for the BSE on the filing date. This implies increased volatility of returns in periods closer to the filing date. For 38 of the 39 firms, volatility of returns increased over the year preceding filing. Rather than viewing these volatile stocks as more valuable, investors are deeply discounting their values due to the perceived extreme downside risk.

To check the sensitivity of our estimates to extraordinary periods, we exclude a total of six firms. These firms either filed for Chapter 11 in the months following the 1987 stock market crash or filed for bankruptcy in 1988 but the returns required to compute their volatility estimates came from the crash period. The results from the reduced sample (not reported here) are not materially different.

Notwithstanding the crudeness of some of the data used to proxy the BS-OPM variables, it is still curious that almost all estimates are greater than actual market prices in each panel. Only 15 of the 39 firms show book value of assets below book value of liabilities, making 24 of the firms technically solvent and therefore having stocks that are the equivalent of in-the-money options. As noted before, all firms in our sample have filed for bankruptcy and therefore their shares must be viewed as deep out-of-the money calls.

In Table 6 we split the sample in Table 5 into two groups: firms with book value of assets less than liabilities ($n = 15$) and firms with book value of assets greater than or equal to liabilities ($n = 24$). As expected, the Black-Scholes estimates are lower for the group with assets less than liabilities. While the mean of the BSEs is relatively closer to the mean of the actual closing prices, the difference in means is nonetheless statistically significant. Thus, even if book value of assets is less than liabilities, the mean BSE is, on average, greater than the observed mean closing price.

The availability of better data on the market value of assets, which presumably would value assets somewhat less than liabilities, would result in a lower call option value. To address the issue of using book values of liabilities and assets, and the fact that only 15 firms show book value of assets less than book value of liabilities, we compute the BSEs using the following decision rules:

- Rule 1: If assets are greater than liabilities, then assets are set equal to liabilities;
- Rule 2: Write down the book value of assets 20 percent;
- Rule 3: Set asset values equal to 40 percent of liabilities.

This last rule is used following Hotchkiss (1995) who found an average ratio of book value of assets to liabilities of 0.4 in her sample of 806 firms that filed for Chapter 11

Table 6—Valuation of 39 Bankrupt Firms, Split According to Book Value of Assets Relative to Liabilities

Each panel of Table 6 is split into two sections. The first section includes 15 firms where the book value of assets is less than the book value of liabilities; the second section includes 24 firms where the book value of assets is greater than or equal to the book value of liabilities. Actual price is the closing price of the firm's stock on the day of filing for bankruptcy. BSE is the value of the stock estimated using the BS-OPM. Difference is calculated as the difference between BSE and actual price for each firm. For some firms, the estimate (BSE) is less than the closing price, making the difference a negative value. Hence the minimum value for all firms under Difference will be negative. T-statistics are reported for the probability that the difference in mean prices (BSE and actual) is equal to zero, with p-values in parentheses

	BSE	Actual Price	Difference	t-statistic (p-val)
Panel A1: TTM = Time Spent in Ch. 11; Annualized σ Based on One Year of Daily Returns; BV Assets < BV Liabilities				
Mean	\$ 8.12	\$ 1.21	\$ 6.91	2.88 (.01)
Median	4.77	1.13	2.77	
Max.	38.83	2.63	31.58	
Min.	0.02	0.09	-1.35	
S.D.	9.29	0.77	9.30	
Panel A2: TTM = Time Spent in Ch. 11; Annualized σ Based on One Year of Daily Returns; BV Assets $\geq$ BV Liabilities				
Mean	\$17.24	\$ 1.59	\$15.66	5.09 (< .01)
Median	14.09	1.19	12.87	
Max.	56.56	5.75	53.68	
Min.	0.56	0.34	0.06	
S.D.	15.82	1.27	15.06	
Panel B1: TTM = 120 Days; Annualized σ Based on One Year of Daily Returns BV Assets < BV Liabilities				
Mean	\$ 4.63	\$ 1.21	\$ 3.42	3.47 (< .01)
Median	3.58	1.13	3.02	
Max.	12.39	2.63	10.26	
Min.	0.00	0.09	-1.59	
S.D.	3.83	0.77	3.82	
Panel B2: TTM = 120 Days; Annualized σ Based on One Year of Daily Returns BV Assets $\geq$ BV Liabilities				
Mean	\$12.19	\$ 1.59	\$10.60	6.24 (< .01)
Median	10.52	1.19	9.27	
Max.	30.16	5.75	25.24	
Min.	0.76	0.34	0.07	
S.D.	9.14	1.27	8.32	
Panel C1: TTM = 120 Days; Annualized σ Based on Three Months of Daily Returns BV Assets < BV Liabilities				
Mean	\$ 6.93	\$ 1.21	\$ 5.72	3.97 (< .01)
Median	6.38	1.13	5.32	
Max.	18.39	2.63	17.14	
Min.	0.00	0.09	-1.38	
S.D.	5.69	0.77	5.58	

Table 6—Valuation of 39 Bankrupt Firms, Split According to Book Value of Assets Relative to Liabilities (continued)

Each panel of Table 6 is split into two sections. The first section includes 15 firms where the book value of assets is less than the book value of liabilities; the second section includes 24 firms where the book value of assets is greater than or equal to the book value of liabilities. Actual price is the closing price of the firm's stock on the day of filing for bankruptcy. BSE is the value of the stock estimated using the BS-OPM. Difference is calculated as the difference between BSE and actual price for each firm. For some firms, the estimate (BSE) is less than the closing price, making the difference a negative value. Hence the minimum value for all firms under Difference will be negative. T-statistics are reported for the probability that the difference in mean prices (BSE and actual) is equal to zero, with p-values in parentheses

	BSE	Actual Price	Difference	t-statistic (p-val)
Panel C2: TTM = 120 Days; Annualized σ Based on Three Months of Daily Returns				
BV Assets $\geq$ BV Liabilities				
Mean	\$15.43	\$ 1.59	\$13.84	5.95 (< .01)
Median	13.45	1.19	12.40	
Max.	46.83	5.75	43.96	
Min.	0.76	0.34	0.13	
S.D.	12.11	1.27	11.40	

Panel D1: TTM = 120 Days; Annualized σ Based on 2 Weeks of Daily Returns
BV Assets < BV Liabilities

Mean	\$ 8.80	\$ 1.21	\$ 7.59	2.67 (.02)
Median	5.61	1.13	4.57	
Max.	44.33	2.63	42.08	
Min.	0.00	0.09	-1.88	
S.D.	11.25	0.77	11.01	

Panel D2: TTM = 120 Days; Annualized σ Based on Two Weeks of Daily Returns
BV Assets $\geq$ BV Liabilities

Mean	\$18.59	\$ 1.59	\$17.01	4.52 (< .01)
Median	14.56	1.19	13.59	
Max.	88.07	5.75	85.19	
Min.	0.77	0.34	0.27	
S.D.	19.07	1.27	18.42	

with the SEC. The results from using the three decision rules are presented in Panels A, B, and C of Table 7.

Consistent with the results in Tables 5 and 6, Panels A and B of Table 7 show that Black-Scholes estimates are generally greater than the market values. The results, however, change dramatically in Panel C (median BSE = \$0.24; median actual price = \$1.13). Of the 39 stocks, BSE is lower than the market price for 33 stocks; 27 stocks are valued closer to the value for shareholders at emergence than the observed market prices on the filing date.

The results in Tables 5 and 7 suggest the following possible explanations. Investors holding bankrupt stocks seem to be aware that such stocks are highly risky and, in general, close to worthless at the time of filing. Like a call option, however, there is some time value in holding these stocks. This explains the positive trading price despite the negative net worth of many bankrupt firms. Alternately, given that risk is assumed

Table 7—Valuation of 39 Bankrupt Firms Using Different Estimates of Assets and Liabilities

Valuation of stocks of 39 bankrupt firms on the day of filing for Chapter 11 using Black-Scholes option pricing model (BS-OPM). The filings occurred from 1986-1993. Actual price is the closing price of the firm's stock on the day of filing for bankruptcy. BSE is the value of the stock estimated using the BS-OPM. Difference is calculated as the difference between BSE and actual price for each firm. For some firms, the estimate (BSE) is less than the closing price, making the difference a negative value. Hence the minimum value for all firms under the difference column will be negative. Summary statistics are provided for the 39 estimates, the 39 closing prices, and the 39 differences. T-statistics are reported for the probability that the difference in mean prices (BSE and actual) is equal to zero, with p-values in parentheses

	BSE	Actual Price	Difference	t-statistic (p-val)
Panel A: If BV of Assets > BV Liabilities, Set Assets = Liabilities				
Mean	\$ 6.37	\$ 1.44	\$ 4.93	5.50 (< .01)
Median	4.89	1.13	3.79	
Max.	26.21	5.75	23.33	
Min.	0.00	0.09	-1.59	
S.D.	5.90	1.11	5.59	
Panel B: Write Down BV of Assets 20 Percent				
Mean	\$ 5.21	\$ 1.44	\$ 3.77	5.67 (< .01)
Median	4.53	1.13	2.31	
Max.	15.59	5.75	14.41	
Min.	0.00	0.09	-1.85	
S.D.	4.63	1.11	4.15	
Panel C: Set Assets Values Equal to 0.4 of BV of Liabilities				
Mean	\$ 0.53	\$ 1.44	\$ -0.92	-3.66 (< .01)
Median	0.24	1.13	-0.95	
Max.	4.87	5.75	4.78	
Min.	0.00	0.09	-1.38	
S.D.	.85	1.11	-5.60	

to be constant over the life of the option and that risk is positively correlated with call option value, this option pricing model may not be appropriate for valuing stocks exhibiting little upside potential.

A final comment is in order on the stock price behavior around filing. We compare the return volatility and trading volume for each firm calculated from different time periods: one year, three months, and two weeks prior to filing and also the two weeks post-filing (Table 4, Panel C). The mean and median volatility of returns as measured by annualized standard deviation of returns increased prior to filing. The mean trading volume increased while the median decreased and then increased in the two weeks prior to filing. Comparing the two weeks prior to filing with the two weeks post-filing, the story is a little different. Mean and median standard deviation of returns decreased slightly, and the mean and median trading volume substantially increased. The median volume more than doubled. This suggests that these stocks of bankrupt companies remain volatile even after filing and that investors may factor the increased risk.

Summary and Conclusions

The results of this study reveal the dangers of investing in common stocks of bankrupt companies. In the current sample, the pre-petition stockholders' investments in 93 of 154 firms were obliterated. Overall, shareholders suffered an average loss of around 70 percent. Nonetheless, these stocks have attracted numerous investors, possibly due to the option-like characteristics of such stocks. Reports in the popular press that positive values on some seemingly worthless stocks are an indication of market inefficiency may be unwarranted in light of the valuation of bankrupt stocks based on the Black-Scholes option pricing model. Based on some of our parameter estimates, Black-Scholes estimates tend to be greater than the observed market values. Crudeness of data and lack of information on bankrupt firms compound the valuation problem. When assets are valued at about 40 percent of liabilities, estimates tend to be less than the observed market values and would imply that investors in these bankrupt firms are overpaying. Future research into this topic will need to overcome the limitation of data availability for these firms in order to settle this question.

References

1. Aharony, J., P.J. Charles, and I. Swary, "An Analysis of Risk and Return Characteristics of Corporate Bankruptcy Using Capital Market Data," *Journal of Finance*, 35 (September 1980), pp. 1001-1016.
2. Altman, E., *Corporate Financial Distress and Bankruptcy* (New York: John Wiley and Sons Inc., 1994).
3. Altman, E., and A. Eberhart, "Do Seniority Provisions Protect Bondholders' Investments?" *Journal of Portfolio Management*, 20 (Summer 1994), pp. 67-75.
4. Buell, S.G., "The Accuracy of the Initial Pricing of Junk Bonds," *Journal of Fixed Income*, 2 (September 1992), pp. 77-83.
5. Blume, M.E., D.B. Keim, and S.A. Patel, "Returns and Volatility of Low-Grade Bonds: 1977-1989," *Journal of Finance*, 46 (March 1991), pp. 49-74.
6. Bradley, M., and M. Rosenzweig, "The Untenable Case for Chapter 11," *Yale Law Journal*, 101 (March 1992), pp. 1043-1095.
7. Clark, T.A., and M.I. Weinstein, "The Behavior of the Common Stock of Bankrupt Firms," *Journal of Finance*, 38 (May 1983), pp. 489-504.
8. Chambers, R.D., and N.J. Lacey, *Modern Corporate Finance* (New York: Harper Collins College Publishers, 1994).
9. Cornell, B., and K. Green, "The Investment Performance of Low-Grade Bond Funds," *Journal of Finance*, 46 (March 1991), pp. 29-48.
10. Eberhart, A., and R. Sweeney, "Does the Bond Market Predict Bankruptcy Settlements?" *Journal of Finance*, 47 (July 1992), pp. 943-980.
11. Fama, E., "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*, 25 (May 1970), pp. 383-417.
12. Fama, E., "Efficient Capital Markets: II," *Journal of Finance*, 46 (December 1991), pp. 1575-1618.
13. Fridson, M.S., and M.A. Cherry, "Initial Pricing as Predictor of Subsequent Performance of High-yield Bonds," *Financial Analysts Journal*, 46 (July-August 1990), pp. 61-67.

14. Hotchkiss, E.S., "Postbankruptcy Performance and Management Turnover," *Journal of Finance*, 50 (March 1995), pp. 3-21.
15. Lang, L.H.P., and R.M. Stulz, "Contagion and Competitive Intra-industry Effects of Bankruptcy Announcements," *Journal of Financial Economics*, 32 (August 1992), pp. 45-60.
16. Ma, C.K., and G.M. Weed, "Fact and Fancy of Takeover Bonds," *Journal of Portfolio Management*, 13 (Fall 1986), pp. 34-37.
17. Morse, D., and W. Shaw, "Investing in Bankrupt Firms," *Journal of Finance*, 43 (December 1988), pp. 1193-1206.
18. Weinstein, M.I., "A Curmudgeon's View of Junk Bonds," *Journal of Portfolio Management*, 13 (Spring 1987), pp. 76-80.
19. Weiss, L.A., "Bankruptcy Resolution: Direct Costs and Violation of Priority Claims," *Journal of Financial Economics*, 27 (October 1990), pp. 285-314.