

# Investing in Chapter 11 Stocks: Liquidity and Performance

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## Abstract

This paper documents the trading environment and negative returns of investing in stocks in Chapter 11. We find that, contrary to the common view, there exists active trading for Chapter 11 stocks throughout the duration of the Chapter 11 process despite high trading costs. We point out that the rationale behind active trading of these stocks is their embedded option value: their returns resemble those of out-of-the-money call options on an equally-weighted industry portfolio. However, investing in Chapter 11 stocks incurs large losses both before and after risk adjustment. The average standardized monthly return over market is -16.6%. We argue that Chapter 11 stocks exhibit large negative returns because they are initially over-valued by optimistic investors' opinions in the context of heterogeneous beliefs, and it is almost impossible to short-sell these stocks. Cross-sectional evidence confirms that firms with higher levels of information uncertainty experience more negative returns in Chapter 11.

**Keywords:** bankrupt equity, option pricing, liquidity, heterogeneous beliefs

**JEL Codes:** G33, G13, G14

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# 1 Introduction

Investment in the securities of distressed firms has drawn large interest in both investment practice and academic research in the past 20 years, due to the increasing number of bankruptcy filings. Mostly, the traded security is distressed debt. The total estimated value of the defaulted loan and distressed debt market reached a peak at \$500 billion in 2002. There have been numerous research papers studying investment performance of distressed debt. In contrast to the extensive knowledge about distressed debt, very little is known about bankrupt equity in regards to its trading environment and performance. This paper intends to shed some light on these topics.

It is widely assumed that all of a corporation's equity is wiped out upon Chapter 11 filings, thus trading ceases to exist for bankrupt stocks, except for short-covering by previous short-sellers. In this paper, using a sample containing 685 Chapter 11 filings between 1998 and 2006, we document that despite initial falling of prices and widening of bid-ask spreads, most bankrupt stocks resume trading either on original main exchanges or on OTC markets such as Pink Sheets. These stocks continue to be traded throughout the Chapter 11 process until the final bankruptcy resolution date. Furthermore, the trading of bankrupt stocks is fairly common even for firms that have been in Chapter 11 for as long as three years. On any given trading day after Chapter 11 filings, more than 50% of the firms in the sample are traded.

Investing in bankrupt stocks is often regarded as irrational behavior by unsophisticated investors who are attracted by the low price levels of these once highly valued stocks. Anecdotal press reports focus primarily on the highly imbalanced winner-to-loser ratio of bankrupt stocks and regard investing in Chapter 11 stocks as being similar to buying lottery tickets. Examining the buy-and-hold returns of bankrupt stocks from the first trading day after Chapter 11 filings to the bankruptcy resolution date, we find that the performance is heavily left-skewed—most of them die out without any payoff, while a small proportion of them pay off tremendously. We show that these payoffs

are not random but related to fundamental performance of underlying firms. Furthermore, we find the return correlation between a bankrupt stock and its same-industry matching firms exhibits strong non-linearity. Specifically, the correlation is significantly positive when the performance of matching firms is relatively good and zero otherwise. This suggests that the payoff structure of bankrupt stocks is similar to out-of-the-money call options. We conjecture that there is a rationale behind the active trading of these seemingly worthless stocks: investors buy bankrupt stocks as a type of investment just as they invest in call options.

However, we find that investing in Chapter 11 stocks is, on average, not profitable. Quite the contrary, such investment generates a large magnitude of loss, both before and after risk-adjustment. In our sample, a buy-and-hold strategy from the first trading day after Chapter 11 filings until resolution date generates an excess monthly return of -16.6% after adjusting for market risk.<sup>1</sup> An early paper by Morse and Shaw (1988) is the only study which also investigates the performance of bankrupt stocks. Using a much smaller sample, they find no abnormal returns on these stocks, although they document a large cross-sectional variation in performance. With a more recent and larger sample, our study is the first paper that documents large losses inflicted by investing in Chapter 11 stocks. Considering that these are negative abnormal returns even after being controlled for conventional risk factors, a rational risk-based model does not seem plausible to explain them. Motivated by the fact that it is almost impossible to short bankrupt stocks traded at Pink Sheets, we argue that bankrupt stocks are initially over-valued by optimistic investors in the context of heterogeneous beliefs with short-sell constraints. When uncertainty finally gets resolved as firms approach bankruptcy resolutions, stock prices converge to their true fundamental value. Meanwhile, stock returns become negative.

Miller (1977) argues that the very uncertain nature of financial markets implies het-

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<sup>1</sup>This should be considered as the lower bound of any actively managed investing activity in bankrupt stocks, since no attempt to discriminate between anticipated successful and unsuccessful resolutions is made.

erogeneous evaluations of the same financial asset. He shows that in a market with restricted short selling (one form of limits to arbitrage) and when investors have heterogeneous beliefs about the value of a risky asset, prices will reflect a more optimistic valuation. Other studies by Morris (1996) and Chen, Hong, and Stein (2002) follow this line and build other price-optimism models. In these models, optimists hold the stock because they have the highest valuations. One important implication of these models is that the larger the disagreement about a stock's value, the higher the stock price relative to its true value, and the lower its future returns. This is exactly the case when we study the cross-section of stock returns in Chapter 11. Using bid-ask spread and intraday volatility as proxies for the dispersion of opinions, we show that firms with higher levels of heterogeneous beliefs experience more negative returns in Chapter 11.

Our paper contributes to the literature in several ways. First, our paper is the first that gives a detailed description about the trading environment of bankrupt stocks with a comprehensive, recent and unique dataset. We provide background knowledge regarding the delisting and subsequent trading on OTC markets of bankrupt stocks. We document active trading activities associated with these stocks.

Second, our paper contributes to the literature of bankruptcy by answering the question of what the value of bankrupt equity is upon Chapter 11 filings. Generally, there have been two conflicting views regarding this question. The first view is based on a rational conjecture that bankrupt equity has an option value as in Merton (1974)'s model, and that the performance of these stocks should be related to the performance of the underlying firm or industry in Chapter 11. Another view consider the value of bankrupt equity as the expected gain of bargaining process during Chapter 11. This expected gain is purely idiosyncratic, and the performance of these stocks is more related to shareholder bargaining power than it is to any other performance measure. We find strong evidence for the first view by demonstrating the resemblance of pay-offs from investing in bankrupt stocks to those of deep out-of-money call options on an equally-weighted industry portfolio.

Last, we also contribute to the literature of heterogeneous beliefs with limits to arbitrage in financial markets by providing a direct test of the model described by Miller (1977). Diether, Malloy, and Scherbina (2002) attempt to test the same model by showing that stocks with higher dispersion in analysts' earnings forecasts earn lower future returns than otherwise similar stocks. Any empirical work related to heterogeneous beliefs with limits to arbitrage needs to answer two fundamental questions: How the bubble is generated and whether the bubble will persist or burst. We believe studying the returns of Chapter 11 stocks provides a more ideal empirical setting to test Miller's model. As shown in the paper, Chapter 11 filings create large information uncertainty regarding the true value of bankrupt stocks: stocks are being delisted from the main exchanges, analysts stop covering the stocks, and legal complications add another layer of uncertainty. Meanwhile, high searching and borrowing costs make it almost impossible to short these stocks. Thus, bankrupt stocks are initially over-valued since optimistic investors tend to hold them. However, the bubble will not persist for these stocks. On the final bankruptcy resolution date, payoffs to these stocks are given by reorganization or liquidation plans, and prices are corrected to reflect their true fundamental value.

The rest of the paper is organized as follows: Section 2 provides a brief literature review. Section 3 discusses the institutional background on delisting and subsequent trading on Pink Sheets. Section 4 describes the data used in this study. Section 5 analyzes the trading activity of bankrupt stocks during the chapter 11 process. Section 6 examines the performance of investing in bankrupt stocks. In Section 7, we explore the determinants of bankrupt stock returns, and we conclude in Section 8.

## **2 Literature Review**

Several papers studying the performance of bankrupt equity before, during, and after Chapter 11 filings are closely related to our study. Clark and Weinstein (1983) examine the behavior of stocks of bankrupt firms before the 1978 Bankruptcy Reform Act, and

find evidence of large losses over long periods prior to bankruptcy. Morse and Shaw (1988) document that trading in bankrupt firms' stocks is becoming more common, and that no abnormal returns appear to be available, which is contrary to what we find in this paper. Altman (1969) examines the possibility of bankrupt firms' equity securities as an investment alternative after firms have petitioned for bankruptcy. He finds that there are insignificant differences of returns between these bankrupt equities and the average return on common stocks listed on NYSE, while the risk of the former is much higher. Aharony, Jones, and Swary (1980) compare the characteristics of risk and return measures for a sample of bankrupt firms with corresponding characteristics of a matched sample of nonbankrupt firms using capital market data. They find that the bankrupt sample displays a pattern of significant negative cumulative returns beginning approximately four years prior to bankruptcy.

Related to our paper, many studies in the literature about about distressed securities have focused on the performance of bankrupt firms and their securities after the distress resolution time. Hotchkiss (1995) studies the accounting performance of bankrupt firms after they emerge from Chapter 11, and shows that over 40 percent of these firms continue to experience operating losses in the three years following bankruptcy. Eberhart, Altman, and Aggarwal (1999) evaluate post-bankruptcy performance of "orphan stocks"—new issuance of equity for firms emerging from bankruptcy. They report evidence of large positive excess returns in the 200 days following emergence.

A large number of papers study the returns and recovery rates of distressed or defaulted bonds and bank loans. Blume, Keim, and Patel (1991) examine the risks and returns of long-term low-grade bonds for the period of 1977-1989. They find that there is no systematic over or under pricing for these securities. A similar study by Cornell and Green (1991) shows that returns of low-grade bond funds are approximately equal to the returns provided by an index of high-grade bonds. A series of publications by Moody's Investors Service such as Carty and Lieberman (1999) describe recovery rates of defaulted loans and bonds across different seniorities, securities, and industries. Alt-

man, Brady, Resti, and Sironi (2005) analyze the relation between the aggregate default rate and recovery rates on corporate bond defaults, and find that recovery rates are a function of supply and demand affected largely by default rates. Acharya, Bharath, and Srinivasan (2007) document empirically the determinants for the recovery of defaulted securities, and find that industry conditions are important factors affecting recovery rates at default and at emergence. This is consistent with the theory described by Shleifer and Vishny (1992), which claims that financial distress is more costly to borrowers if they default at times when their competitors in the same industry are also having cash-flow problems.

There is also a large literature on limits to arbitrage pointing out that mispricing can sometimes persist for a lengthy period of time, since arbitrageurs need to bear costs and assume risks for arbitrage activities (see DeLong, Shleifer, Summers, and Waldmann (1990) and Shleifer and Vishny (1997)). A number of studies use this argument to explain several financial market anomalies. Lee, Shleifer, and Thaler (1991) and Gordon Gemmill (2002) study the close-end fund discount puzzle, and argue that there is a presence of irrational traders and arbitrageurs are limited in their ability to bring the value of discounted funds close to their underlying asset value. A recent paper by Gabaix, Krishnamurthy, and Vigneron (2007) examines the mortgage-backed securities market from this same perspective.

### **3 Institutional Background on Delisting and Subsequent Trading on Pink Sheets**

To better understand the trading environment around and after the filing of bankruptcy, we provide some institutional background on the delisting from major exchanges for firms that file for Chapter 11 and their subsequent trading on Pink Sheets. For more detailed information regarding delisting in general, see Angel, Harris, Panchapagesan,

and Werner (2004), who study shareholder loss due to delisting, and Macey, O'Hara, and Pompilio (2005) who examine the legal and economic aspects of the delisting process. Bollen and Christie (2007) also study the market microstructure of Pink Sheets OTC markets.

By listing stocks, exchanges provide several services: monitoring of trading, clearing and settlement, liquidity, and a signaling function about a firm's quality. The exchange benefits by collecting fees from trading. When the trading of one security becomes so limited, it's no longer profitable for the exchange to list it, or the quality of the company deteriorates so severely that it would harm the exchange's reputation, the exchange will delist the security.

Specific delisting rules vary from exchange to exchange. For example, NYSE will consider delisting a firm if the number of total stockholders drops below 400, the average monthly trading volume for the previous 12 months is less than 100,000 shares, or if the average closing price of a security is less than one dollar over a consecutive 30-day trading period. If the company files for bankruptcy or announces its intention to file, the exchange will also consider delisting it. NASDAQ will consider delisting a stock if the stockholders' equity is less than \$10 million, the bid price is less than one dollar for 30 consecutive trading days, or there are less than two market makers for 10 consecutive business days. Both NYSE and NASDAQ may delist companies that do not meet their corporate governance listing standards. The legal requirements of delisting is rather complex. In summary, the following are the most common reasons: insufficient market makers, insufficient number of share holders, stock price falling below acceptable levels, insufficient capital, bankruptcy, delinquency in filing and non-payment of fees, failure to register under 12G of Securities Exchange Act, failure to meet exception or equity requirement, corporate governance violation, composition of unit that is not acceptable, and protection of investors and the public interest.

Given the above delisting standards, it is not hard to understand why firms that file for bankruptcy are normally also delisted from the main exchange before or after the



bankruptcy filing. When the firm is in distress, several things could happen even before the actual bankruptcy filing: its market capitalization could shrink, its stock trading could become scarce, or its price level could fall below a certain level. These events could cause immediate delisting even before the actual filing. Even if it is not delisted before filing, the firm will be delisted after the filing because bankruptcy itself is one of the delisting standards. Delisting, however, is not a universal process that has a clear time frame. Two companies in similarly distressed situations facing the threat of delisting could have different resolution results regarding delisting. The reason for this is because exchanges have significant discretion in the application of these rules, and a firm is given the right to delay the delisting to some extent if it chooses to do so.

So what happens if the firm is eventually delisted? The firm will not be able to list itself in any other trading venue, however, trading could resume on the OTC Bulletin Board or the Pink Sheets as long as there is at least one market maker who is willing to quote the security regardless the firm's will. Thus, the security is quoted or not quoted instead of listed or unlisted in these trading venues, but for bankrupt stocks, it's very unlikely that the firm will end up on the OTC bulletin Board, but instead on Pink Sheets if there is a market maker willing to quote it. The market maker needs to file an application with the NASD before starting quoting the stock. The market maker also has to show that it has access to the latest financial statements of the firm.

The Pink Sheets market grew out of the price quotations for unlisted stocks that were originally published daily on pink sheets of paper by the National Quotation Bureau. Essentially, the Pink Sheets market is a forum for market makers to post quotes and execute trades. It is formally a Securities Information Processor and an Interdealer Quotation System. Issuers do not list their securities and pay no fees to Pink Sheets if their stocks are quoted or traded there. In 1999 the Pink Sheets introduced electronic quotations. On February 14, 2003, Pink Sheets started allowing issuers to sponsor real-time quote display for their stocks on [www.pinksheets.com](http://www.pinksheets.com). On June 2, 2003, they introduced PinkLink - an electronic messaging and automated trade negotiation service.

One unique feature of Pink Sheets is that the issuers do not need to register their securities with SEC, nor are they required to be current in their reporting requirements. It also has trading rules that are different from the major exchanges. For example, there is no rule like NYSE's uptick rule or NASDAQ's short sale rule. It is also difficult to borrow shares traded on Pink Sheets, making short selling difficult. There are no tick size rules, so trades can take place in any price increment. As expected, most stocks traded on Pink Sheets are penny stocks and have worse liquidity than those of the main exchanges.

## 4 Data Description

We first compile a sample of bankruptcy filings between 1998 and early 2006 from [www.bankruptcydata.com](http://www.bankruptcydata.com). On any given day in Chapter 11, if the stock is already delisted from the main exchange and is traded on Pink Sheets, we gather trading data from Pink Sheets Inc., which provides their daily highest trading price, daily lowest trading price, daily closing price, daily bid and ask quotes, and daily trading volume; if the stock is not delisted, we gather the same data from CRSP. The confirmation date and effective date of the reorganization plans are provided by Prof. Ed Altman. We gather the accounting information of these firms from the latest quarterly company SEC filings before the bankruptcy filing. To guarantee that the accounting information accurately describes sample firms' conditions at the time of Chapter 11 filings, we require all sample firms to have the latest quarterly filings within six months prior to Chapter 11 filings. Our final sample consists of 685 Chapter 11 filing cases.

Table 1 shows the distribution of final outcomes of Chapter 11 filings and the time firms spend in Chapter 11. We classify the final outcomes into five categories: (1) Emerged or Reorganized; (2) Liquidated or Converted to Chapter 7; (3) Acquired, Merged, or Sold; (4) Case Dismissed by the court; and (5) Unknown. Note that for most "Unknown" cases, there is a confirmation date available in the data, only the

outcome is missing. So these cases are by no means abandoned by the court or claimholders. Among the 546 firms with known outcomes, successful reorganization cases account for about half of the sample, while liquidation cases account for the other half. We also calculate the time length in terms of calendar days from bankruptcy announcement date to final resolution date (reorganization confirmation date, liquidation date, or the date of conversion to Chapter 7). The median duration of all bankruptcies is one year. Interestingly, we find that firms that are reorganized successfully spend less time in bankruptcy than the ones that are liquidated, with median durations of 258 days and 394 days respectively. Table 2 shows the distribution of outcomes sorted by bankruptcy filing year. The number of successful reorganizations remains almost the same as the failing ones except in 2001. The bubble period apparently generates more liquidation than successful reorganization. The diversity of bankruptcy resolution outcomes indicates that our sample is a valid sample to study regarding the performance of Chapter 11 stocks.

Table 3 gives the descriptive statistics of characteristics for firms with financial statement information around bankruptcy filing. Panel A provides the distribution summary statistics of the sample. The median asset value of the sample is \$133 million with standard deviation of \$3,042 million, which means that the sample is not concentrated on small or big firms. Both the median of net income and book equity is negative. Leverage is calculated as the ratio of all liabilities to all assets, with median value of 0.98. This shows that sample firms are, on average, in bad operating conditions and highly levered at the time of Chapter 11 filings. Panel B is the correlation matrix of firm characteristics. It suggests in our sample smaller firms tend to be in a worse situation with higher leverage, less tangible assets ratio, and worse profitability.

Table 4 shows the distribution of stocks price levels two trading days prior to the bankruptcy filing date, sorted by the trading venue where they are listed/traded. It shows that about half of the firms in the sample are already delisted from the main exchanges and are being traded on Pink Sheets two trading days before bankruptcy

filing date. It is also obvious that prices of stocks traded on Pink Sheets are much lower than the ones traded on main exchanges. NYSE has, on average, the highest price levels for bankrupt stocks. This is consistent with the fact that the low price level itself is one of the delisting rules.

## 5 Trading Activity of Bankrupt Stocks

There has been little known about trading activity for bankrupt stocks in the literature. One reason is that these stocks are delisted shortly either before or after the bankruptcy filing event, and its subsequent trading data is not covered by traditional datasets like CRSP. The other reason is that people generally have the impression that equity is wiped out upon Chapter 11 filings, and thus trading does not resume for long after the filings. Using trading data provided by Pink Sheets, we are able to examine the trading activity around and after the bankruptcy filing.

Table 5 compares the average price level, spread, volatility, and volume of three groups of bankrupt stocks in three periods: Day(-31, -1), 30-day window before bankruptcy filing; Day(1, 30), 30-day window after bankruptcy filing; and Day(30, 60), the 2nd 30-day window after bankruptcy filing. During each period, we show price and liquidity statistics for three groups sorted by the delisting time as well as the total sample. Group 1 consists of 313 stocks which are delisted more than 30 days before bankruptcy filing. Group 2 are 314 stocks that are delisted in the period of 30 days before and after their bankruptcy filings. Group 3 are 58 stocks that are delisted more than 30 days after their bankruptcy filings. We sort stocks by delisting time because delisting itself is an endogenous event determined by firm quality. Thus, early delisting reflects a more severe distress of the company.

Group 1 is delisted the earliest and has the lowest price. The median price per share of group 1 is \$0.11 in (-30, -1) window and declines to \$0.05 in (1, 30) and to \$0.04 in (30, 60) window. For group 2, price drops from \$0.48 to \$0.09 and further to \$0.07. For

group 3, price drops from \$1.02 to \$0.60 and further to \$0.49. Among the three groups, group 2 has the biggest drop within the 60-day window around filing time, because they are also delisted in that period. To the extent that delisting itself is endogenous, group 2 must have experienced the largest deterioration of firm quality in this period.

To shed some light on the trading cost and liquidity of these stocks, we analyze the change of quoted spread before and after Chapter 11 filings. Chapter 11 filings dramatically increase quoted spread across all groups. Group 1 has the highest pre-bankruptcy percentage spread of 18%, which is actually lower than the median spread of Pink Sheets market documented in Bollen and Christie (2007). For group 2 and 3 they are around 10% to 11%, which is high considering that some of them are still listed on the main exchanges. After filing, percentage spread jumps to 26%, 26%, and 17% for groups 1, 2 and 3 respectively. The spread jump is a result of the large information uncertainty regarding the true value of these securities brought upon by Chapter 11 filings.

The intra-day price range calculated by dividing the difference of daily highest price and daily lowest price by daily close price is used as a proxy for daily volatility. Group 2 has the highest daily volatility, since it is delisted around the time window of interest. Daily volume further documents the liquidity deterioration of delisting and bankruptcy filing. For group 1, since it is delisted before the time window of interest, the trading peak happens in the one month period after the filing, which is apparently driven by bankruptcy filing news. A similar pattern is observed for group 3. However, for group 2, trading volume decreases persistently after filing due to delisting.

To investigate the trading behavior of bankruptcy stocks in the longer term, we examine the trading activities of bankrupt stocks until the final bankruptcy resolution date. The resolution date is the resolution confirmation date determined by the bankruptcy court for firms that are reorganized successfully or liquidated. For firms that are converted to Chapter 7, the resolution date is the conversion date. Figure 1 shows the total population of firms remaining in the Chapter 11 process at any given trading day after

bankruptcy filing. After 250 trading days, which is about one calendar year, approximately half of the firms already emerge out of Chapter 11 or get liquidated. Figure 2 shows the number of firms that are traded as a percentage of all bankrupt firms at any trading day in Chapter 11. It suggests that trading of bankrupt stocks is far more than scarce, even for stocks that have been in Chapter 11 for 3 years. The percentage of traded firms is well above 50% on most trading days.

In summary, by examining key aspects of equity trading around and after Chapter 11 filings, we discover some striking findings. Namely, upon the announcement of bankruptcy filings, prices will drop, spread will widen, and trading might be halted for a few days or several weeks. However, most of these stocks will eventually resume trading on either Pink Sheets or on the main exchanges. Furthermore, most stocks will be traded throughout the Chapter 11 process until the final bankruptcy resolution date. In the following section, we will examine the performance of investing in these bankrupt stocks.

## **6 Holding Period Returns of Bankrupt Stocks: Resemblance to Out-of-money Call Options**

Anecdotal press reports mention that there is a high imbalance between the “winner vs. loser” among bankrupt stocks, and they make an analogy of these stock with “lottery tickets”. Thus, some people hold the view that returns of bankrupt stocks solely depend on the idiosyncratic legal process of bargaining and are not related to fundamental performance of the underlying firm. There is another conflicting view that bankrupt equity has an option value as in Merton’s (1974) model, and performance of these stocks should be related to the performance of the underlying firm or its industry in Chapter 11. We study this question in this section.

We define holding period returns of bankrupt stocks as the returns from the first

trading day after Chapter 11 filing to the last trading day before the bankruptcy resolution date. We consider this period to be the main distress period of interest. Some firms are traded briefly after the resolution date; in this case, the last trading day is the resolution date. Denote holding period returns by  $HPR$ :

$$HPR = (P_{last} - P_{first}) / P_{first}, \quad (1)$$

where  $P_{last}$  is the price of the last trading day of the holding period, and  $P_{first}$  is the first trading day of the holding period.

To investigate the “winner vs. loser” ratio of bankrupt stocks, Figure 3 gives the histogram and distribution statistics of  $HPR$ . The histogram of  $HPR$  is truncated at the right, with extreme values greater than 1000% not presented. It confirms anecdotal press reports and shows that the distribution of holding period returns  $HPR$  is heavily left-skewed. In fact, about one third of the 609 firms have a return less than -95%.

We further investigate whether this pattern of payoffs is generated randomly through idiosyncratic bargaining process like “lottery tickets”, or actually related to fundamental performance of the underlying companies. As a first-step analysis, we scatter plot holding period returns of bankrupt stocks against average returns of matched firms over the same period, as shown in Figure 4. The matching firms are constructed as follows: For each bankrupt company, at the time of bankruptcy filing, we select all the firms that have the same first two digits of the industry SIC code and sort them into deciles by book asset value. The matching firms would be the ones that are in the same asset size decile as the distressed firm in the same industry. We then calculate the equally-weighted holding period return of the matching sample. As the scatter plot shows, there are quite a few stocks with extreme large positive  $HPR$  on the righthand side of the graph (where performance of matched firms is relatively good), while most stocks have a return of close to -100% on the lefthand side. To test in a more rigorous way the relation between the performance of bankrupt stocks and the matched firms, we estimate the following

piecewise linear regression:

$$HPR_i = (1 - \sigma_i) * (\gamma_{low} + \beta_{low} * HPR_{match,i}) + \sigma_i * (\gamma_{high} + \beta_{high} * HPR_{match,i}), \quad (2)$$

where  $HPR_i$  is the holding period return for bankrupt stock  $i$ ,  $HPR_{match,i}$  is the equally-weighted average return of matching firms for bankruptcy stock  $i$  over the same holding period, and  $\sigma_i$  is a dummy variable (1 if the average return of matching firms is above a threshold, and 0 otherwise).

To ensure continuity, we impose the following restriction on  $\gamma_{low}$ ,  $\beta_{low}$ ,  $\gamma_{high}$  and  $\beta_{high}$ :

$$\gamma_{low} + \beta_{low} * (Threshold) = \gamma_{high} + \beta_{high} * (Threshold). \quad (3)$$

We select *Threshold* by maximizing the R-square of the piecewise regression. Figure 5 plots the fitted lines of the piece-wise regression for the entire sample. we show that the return correlation between a bankrupt stock and its same-industry matching firms exhibits strong non-linearity: the correlation is significantly positive when the performance of matching firms is relatively good and zero otherwise. This finding suggests that the returns to bankrupt stocks are similar to those obtained from buying out-of-money call options on an equally weighted portfolio of matched firms. Furthermore, we provide evidence that returns of Chapter 11 stocks are related to the underlying firm performance instead of “lottery tickets” being generated by idiosyncratic bargaining process.

Having established that bankrupt equity has an option value on underlying firm assets, we conjecture that the option payoff structure could be more pronounced for some firms than others, depending on whether a firm is expected to be reorganized. The option value is only viable if the firm is expected to continue its business, and there is a volatility value regarding its future business success. If a firm is expected to be liquidated, and there is no uncertainty about its future business, then there is hardly any option value embedded in equity. Rather, equity value is just a linear function on the firm’s liquidation value. In addition, liquidation value largely depends on industry



performance due to fire-sale of the assets. Thus, returns for bankrupt firms expected to be liquidated should simply be a linear function of industry performance. This is confirmed in the data as shown in Figure 6. It shows the fitted lines of piece-wise regressions for the sub-sample of firms, grouped by their eventual resolution outcomes: the ones getting reorganized, and the ones liquidated or converted to Chapter 7. For the sub-group that is eventually reorganized, the resemblance to option payoffs are more dramatic: while the fitted line is almost flat when average returns of matching firms are negative, the fitted line slopes upwards as average returns of matching sample become positive. On the other hand, for the sub-group that are eventually liquidated or converted to Chapter 7, it is almost one straight line.

## 7 Negative Bankrupt Stock Returns

Since some bankruptcy cases get resolved earlier than others, holding period returns of different bankrupt stocks represent performance over different time horizons. Also raw holding period returns are not adjusted for risk. Thus we use two other alternative measures for performance. The first measure is *MHPR* which is standardized monthly excess return over market:

$$MHPR_i = (1 + HPR_i)^{21/t_i} - (1 + HPR_m)^{21/t_i}, \quad (4)$$

where  $t_i$  is the number of trading days during the holding period for stock  $i$ ,  $HPR_m$  is the equally-weighted NYSE/AMEX/NASDAQ market index return over the same holding period.

The second measure aims to adjust for risk by the Fama-French-Carhart 4-factor model (Fama and French (1992), Fama and French (1993), Carhart (1997)). we first estimate a time-series regression for each bankrupt stock using its daily returns over the holding period, then use the intercept ( $ALPHA_i$ ) as a measure of risk-adjusted return

for stock  $i$ .

Table 6 gives distribution statistics of  $HPR$ ,  $MHPR$ , and  $ALPHA$  for sample stocks. The performance of bankrupt stocks is significantly negative with t-statistics for  $HPR$ ,  $MHPR$  and  $ALPHA$  equal to -4.3, -24.4 and -11.2 respectively. What is even more striking is the large magnitude of these negative returns across all measures. Average holding period return is -33.3% and after standardized into monthly excessive return above market it is -16.5%. Fama-French-Carhart risk-adjusted measure shows a daily abnormal return of -1.2%.

Table 7 gives the distribution statistics of  $HPR$  and  $MHPR$  sorted by initial price level, final outcome and delisting time. Initial price level is a proxy for size of the company. Final outcome is relevant because successfully reorganized firms are supposedly the ones with better operating performance during Chapter 11 and we expect these stocks to exhibit better returns. Delisting is endogenous as a result of bad performance and in return it also affects stock prices adversely as shown in Angel, Harris, Panchapagesan, and Werner (2004). The data confirms the hypothesis: firms that are eventually reorganized successfully experience less negative returns than others and firms that are delisted within Chapter 11 show more negative returns than others.

In the previous section, we argue there is a rationale behind active trading of Chapter 11 stocks since they have an option value. Option theory indicates that expected return of a call option is determined by the expected return of its underlying asset. Given that expected returns for call options are normally positive, the negative abnormal returns of these stocks are not explained by a rational risk-based model. Thus, we resort to the models of heterogeneous beliefs with short-sale constraints. According to Miller (1977), in a market with restricted short selling and when investors have heterogeneous beliefs about the return of a risky asset, prices will reflect a more optimistic valuation. The cross-sectional prediction of Miller (1977) is that the larger the disagreement about a stock's value, the higher the market price relative to the true value of the stock, and the lower its future returns. We argue that this is exactly the case for Chapter 11

stocks. As shown in the following analysis, Chapter 11 filings result in large information uncertainty about the true value of the stocks and it is almost impossible to short sell these stocks. As a result, they are initially over-valued by optimistic investors upon Chapter 11 filings. However as they approach bankruptcy resolution date, uncertainty gets resolved and prices are corrected to reflect the true value of stocks and we observe negative returns of these stocks.

## **7.1 The Impact of Chapter 11 Filings on Information Uncertainty and Short-sale Constraints**

When a firm files for Chapter 11, it has a large impact on the information uncertainty of its stock. There are several reasons for this impact. First, since bankruptcy filing is one of the delisting rules for main exchanges, many stocks are delisted around (or not long after) Chapter 11 filings. Since OTC markets such as Pink Sheets don't have listing rules as strict as main exchanges, public information disclosure is not mandatory for these stocks. As a result, public information about these stocks is getting more scarce. Second, most institutional investors cannot hold bankrupt stocks, as stipulated in their investment mandates. Thus, many sell-side analysts stop following the stock if the firm files for Chapter 11. This further aggravates the problem of scarce public information available for these stocks. Lastly, Chapter 11 is a legal process in nature, and the legal complexity adds more uncertainty to what shareholders will eventually get on bankruptcy resolution date.

The increased information uncertainty can clearly be seen in the data of quote spreads. Figure 7 plots the time series of quoted spread 21 trading days before to 21 trading days after the filings. The large spike centering around Chapter 11 filing date shows dramatically increased information uncertainty of stocks due to filings.

Short-selling is generally very difficult for bankrupt stocks. Many institutional investors cannot invest in bankrupt stocks due to regulation requirements. Most individual

investors are prohibited from investing in these stocks via restrictions from their brokerage firms on marginable trades. As a result, these stocks are not widely held by either institutional or individual investors. Therefore, the substantially increased searching and borrowing costs of bankrupt stocks make them much less attractive to arbitrageurs. Furthermore, the bankrupt stocks are very susceptible to short squeeze. Rumors about bankrupt companies often lead to a rapid increase in the stock price without any justifiable reasons. Therefore, short-sale constraints are tightly binding for bankrupt stocks.

## **7.2 Information Uncertainty and Cross-section of Chapter 11 Stock Returns**

As shown above, increased information uncertainty upon Chapter 11 filings and short-sale constraints on these stocks generate overvaluation upon filings. In addition, there is a unique feature of bankrupt equity: the final payoff is specified by reorganization or liquidation plans at the final bankruptcy resolution date. In other words, if there is any mispricing of bankrupt stocks during the Chapter 11 process due to heterogeneous beliefs, such mispricing will eventually be corrected on or before the resolution date. In this sense, examining the returns of bankrupt stocks provide a unique opportunity to test the theory about heterogeneous beliefs with limits to arbitrage in financial markets. Miller (1977) predicts that those bankrupt stocks with higher levels of heterogeneous beliefs should have lower realized returns.

We measure the level of heterogeneous beliefs of a bankrupt stock with two variables. The first one is the average daily bid-ask spread of the stock over its trading period within Chapter 11. Bid-ask spread has two components, an information asymmetry-related component and a liquidity-providing component. For bankrupt stocks, the former should be the dominant one, due to the lack of public information about these stocks. The second variable is the average intra-day volatility, which is calculated as the difference between the daily highest trading price and lowest trading price, divided by the closing

trading price. The daily fluctuation of trading price should reflect the difference of opinions of the stocks. The following regression is estimated:

$$MHPR_i = \alpha + \beta_1^* Daily\_Spread_i + \beta_2^* Daily\_Volatility_i + Control\ Variables + \varepsilon_i, \quad (5)$$

where *Daily\_Spread* is the average daily bid-ask spread of the stock during the Chapter 11 process, *Daily\_Volatility* is the average intraday volatility calculated as the difference between the daily highest trading price and lowest trading price, divided by the closing trading price.

The results are shown in Table 8. It shows that heterogeneous beliefs have significantly negative impact on the performance of bankrupt stocks. The t-statistics of the average daily spread and average intraday volatility are -4.07 and -2.53, respectively, in the regression without any control variables. In addition, the coefficients of these two measures remain significant even after including various control variables in the regression. Furthermore, it appears that these two measures can explain a substantial portion of the cross-sectional variation of bankrupt stock returns with R-squared equal to 5% without the control variables and 7% with the control variables.

As an alternative way to control for risk, we also examine the relation between the risk-adjusted return (as measured by the intercept of Fama-French-Carhart 4-factor model) and the proxies for heterogeneous beliefs.

$$ALPHA_i = \alpha + \beta_1^* Daily\_Spread_i + \beta_2^* Daily\_Volatility_i + Control\ Variables + \varepsilon_i, \quad (6)$$

The results are shown in Table 9. Similar to the findings on *MHPR*, we confirm

that heterogeneous beliefs have negative impact on the risk-adjusted returns of bankrupt stocks. The coefficients of the average daily spread and average intraday volatility remain statistically significant in all specifications with or without control variables. In summary, consistent with the prediction of Miller (1977), we find that bankrupt stocks with a higher level of heterogeneous beliefs have lower realized returns. These results are unaffected by the final resolution outcome, or whether the firm is delisted from major exchanges during the Chapter 11 process. Thus, we confirm the hypothesis that bankrupt stocks are initially over-valued at the time of Chapter 11 filing because optimistic investors choose to hold these stocks, and pessimistic investors cannot short-sell. Furthermore, due to the large extent of information uncertainty of these bankrupt stocks, the magnitude of initial over-valuation is tremendous given the observed realized returns of these stocks within Chapter 11.

## 8 Conclusions

Our paper sheds light on the trading and performance of bankrupt stocks within Chapter 11 process using a unique dataset from Pink Sheets. First we show that there is far more active trading of these stocks through the Chapter 11 process than people would generally expect. Second, we find that there is a rationale behind active trading of these seemingly worthless stocks because these stocks have option value: investment returns in Chapter 11 stocks resemble those of deep out-of-the-money call options on an equally weighted industry portfolio. Last, we document the performance of investing in Chapter 11 stocks: they, on average, exhibit large magnitude of negative returns both before and after adjustment for risk. The large magnitude of negative returns of these stocks cannot be explained by rational risk-based models. We argue that the negative returns are the result of an initial over-valuation at the time of filing, due to large magnitude of information uncertainty upon Chapter 11 filing and the fact that it's almost impossible to short-sell these securities as in the context of Miller (1977).

As the bankruptcy resolution date approaches, uncertainty is resolved regarding the true value of these stocks. As mispricing gets corrected, the stocks show large negative returns. Cross-sectional evidence also supports this hypothesis: bankrupt stocks with higher levels of information uncertainty have more negative returns in Chapter 11.

Morse and Shaw (1988) also study the performance of bankrupt stocks with 56 firms in their sample, and they find no abnormal returns. Revisiting the question of investing in bankrupt stocks after 20 years with a much larger sample, we contribute to the literature with new findings. Our paper is the first to provide a thorough understanding regarding the trading, value, and performance of these stocks. We also contribute to the literature of heterogeneous beliefs with short-sell constraints by providing a direct test to Miller (1977).

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**Table 1: Bankruptcy Outcomes and Duration of Chapter 11 Process**

Distribution of the final outcomes and the duration of the Chapter 11 process. The sample consists of the 685 cases that were filed between 1998 and 2006. There are five categories of outcomes: (1) Emerged or Reorganized; (2) Liquidated or Converted to Chapter 7; (3) Acquired, Merged, or Sold; (4) Case Dismissed by the court; and (5) Unknown. Duration (D) is the time length from bankruptcy announcement date to final resolution date (reorganization confirmation date, liquidation date, or the date of conversion to Chapter 7), which is measured in terms of calendar days.

Outcome	No. of Cases	Percent	Min(D)	Median(D)	Max(D)	Mean(D)	StdDev(D)
Emerged or Reorganized	235	34.3	29	258	1541	351	284
Liquidated or Converted to Ch7	211	30.8	1	394	1955	492	383
Acquired, Merged, or Sold	64	9.3	47	371	1495	420	272
Case Dismissed	36	5.3	11	608	2126	629	537
Unknown	139	20.3	38	352	1584	430	312
Total	685	100.0	1	341	2126	432	345

**Table 2: Bankruptcy Outcomes Over Time**

Distribution of bankruptcy outcomes sorted by bankruptcy filing year from 1998 to 2006. There are five categories of the final outcomes of bankruptcy when firms come out of Chapter 11 process: (1) Emerged or Reorganized; (2) Liquidated or Converted to Chapter 7; (3) Acquired, Merged, or Sold; (4) Case Dismissed by the court; and (5) Unknown.

Bankruptcy Filing Year	Emerged or Reorganized	Liquidated or Converted to Chapter 7	Acquired, Merged, or Sold	Case Dismissed	Unknown	Total
1998	23 36.5%	19 30.2%	3 4.8%	4 6.4%	14 22.2%	63
1999	23 29.9%	26 33.8%	4 5.2%	5 6.5%	19 24.7%	77
2000	36 33.6%	33 30.8%	7 6.5%	11 10.3%	20 18.7%	107
2001	37 23.7%	63 40.4%	13 8.3%	7 4.5%	36 23.1%	156
2002	45 35.7%	36 28.6%	16 12.7%	2 1.6%	27 21.4%	126
2003	37 41.6%	24 27.0%	11 12.4%	4 4.5%	13 14.6%	89
2004	21 53.9%	5 12.8%	6 15.4%	3 7.7%	4 10.3%	39
2005	10 43.5%	5 21.7%	3 13.0%	0 0.0%	5 21.7%	23
2006	3 60.0%	0 0.0%	1 20.0%	0 0.0%	1 20.0%	5

**Table 3: Firm Characteristics**

Characteristics of firms that filed for Chapter 11 between 1998 and 2006. Panel A reports the summary statistics. Panel B reports the correlation matrix (Pearson below the diagonal and Spearman above the diagonal). Accounting information is from the latest quarterly filing before bankruptcy announcement date. Leverage is the ratio of total liabilities over total assets; Tangible Ratio is the ratio of tangible assets over total assets; ROA is the ratio of EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets.

**Panel A: Summary Statistics**

	N	MIN	Q1	MEDIAN	Q3	MAX	MEAN	StdDev
Total Assets (MM\$)	675	0.02	31.90	133.15	472.23	52285.60	789.29	3042.78
Net Income (MM\$)	681	-3197.00	-35.82	-8.74	-2.26	48.21	-58.45	214.58
Book Equity (MM\$)	671	-7316.70	-37.60	-1.12	25.25	6584.07	-32.41	602.43
Leverage	674	0.02	0.77	0.98	1.33	77.36	1.42	3.44
Tangible Ratio	663	0.00	0.11	0.27	0.49	0.94	0.32	0.24
ROA	612	-21.56	-0.08	-0.01	0.01	0.11	-0.10	0.88

**Panel B. Correlation Matrix**

	Total Assets	Net Income	Book Equity	Leverage	Tangible Ratio	ROA
Total Assets	1	-0.61 (0.00)	0.06 (0.14)	-0.09 (0.02)	0.26 (0.00)	0.48 (0.00)
Net Income	-0.56 (0.00)	1	0.19 (0.00)	-0.13 (0.00)	-0.27 (0.00)	0.06 (0.12)
Book Equity	0.02 (0.57)	0.21 (0.00)	1	-0.77 (0.00)	-0.15 (0.00)	0.02 (0.56)
Leverage	-0.03 (0.41)	0.02 (0.68)	-0.04 (0.26)	1	0.08 (0.04)	-0.03 (0.50)
Tangible Ratio	0.16 (0.00)	-0.12 (0.00)	-0.11 (0.00)	-0.08 (0.04)	1	0.15 (0.00)
ROA	0.03 (0.46)	-0.02 (0.62)	-0.01 (0.88)	-0.76 (0.00)	0.04 (0.33)	1

p-values in parenthesis.

**Table 4: Price Distribution before Bankruptcy Filing**

Price distribution before bankruptcy filing. Price levels are measured two trading days before the bankruptcy filing. Results are sorted by the trading venue where the stocks are listed/traded.

Exchange	N	Min	Q1	Median	Q3	Max	Mean	StdDev
NYSE	64	0.0470	0.3625	0.6560	1.3750	11.6500	1.1761	1.7076
AMEX	35	0.0310	0.1300	0.2400	0.8700	8.5000	0.7396	1.4534
NASDAQ	198	0.0150	0.2180	0.4370	0.8590	4.9300	0.6350	0.6735
Pink Sheets	357	0.0001	0.0400	0.0900	0.1875	3.0000	0.1822	0.2986
Total	654	0.0001	0.0700	0.1870	0.5300	11.6500	0.4464	0.8261

**Table 5: Trading and Liquidity of Bankrupt Stocks around Bankruptcy Filing**

Trading and Liquidity of bankruptcy stock before and after Bankruptcy Filing. The three trading periods considered are: Day(-31,-1), 30-day window before bankruptcy filing; Day(1,30), 30-day window after bankruptcy filing, and Day(31,60), the 2nd 30-day window after bankruptcy filing. During each period, we show price and liquidity statistics for the three sub-groups sorted by the delisting time. Group 1 consists of 313 stocks which are delisted more than 30 days before bankruptcy filing. Group 2 are 314 stocks that are delisted during the period of 30 day before and after bankruptcy filing. Group 3 are 58 stocks that are delisted more than 30 days after bankruptcy filing.

	Groups	Day(-30, -1)			Day(1,30)			Day(31,60)		
		Median	Mean	Stdev	Median	Mean	Stdev	Median	Mean	Stdev
Transaction price (in \$1)	1	0.11	0.21	0.33	0.05	0.12	0.25	0.04	0.13	0.28
	2	0.48	0.75	0.77	0.09	0.18	0.32	0.07	0.15	0.24
	3	1.02	1.78	2.46	0.60	1.14	1.95	0.49	1.21	2.22
	total	0.26	0.60	1.02	0.07	0.24	0.70	0.06	0.23	0.76
Percentage spread (in%)	1	18	27	25	26	34	31	26	37	35
	2	11	17	21	26	42	43	21	37	42
	3	10	15	11	17	26	24	14	23	24
	total	14	22	24	25	37	36	23	37	38
(High-Low)/Close (in %)	1	16	24	44	20	51	167	14	56	341
	2	21	36	218	46	564	6742	27	122	576
	3	16	17	7	18	22	15	17	29	42
	total	19	29	153	27	257	4300	20	83	449
Daily share volume (in 1,000 shares)	1	34	246	940	60	210	521	28	144	360
	2	1336	7949	27773	204	1651	4405	79	326	1378
	3	1557	17041	62045	1709	14048	42525	946	13264	52017
	total	283	5291	26716	122	2061	13618	60	1354	15610
Daily dollar volume (in \$1,000)	1	4	36	145	3	27	135	1	19	87
	2	501	5855	28141	20	311	1383	5	65	422
	3	1361	34037	127520	336	19312	62171	355	15606	57840
	total	79	5698	42881	7	1916	19522	3	1389	17442

**Table 6: Performance of Bankrupt Stocks**

Return distributions of bankruptcy stocks. The holding period is defined as the number of days from the first trading day after bankruptcy to the last trading day before the resolution date. The holding period return ( $HPR$ ) is defined as follows:

$$HPR = (P_{last} - P_{first}) / P_{first}, \quad (7)$$

where  $P_{last}$  is the price of the last trading day of the holding period and  $P_{first}$  is the first trading day of the holding period. The excess average monthly return  $MHPR$  is defined as follows:

$$MHPR = (1 + HPR)^{21/t} - (1 + HPR_m)^{21/t}, \quad (8)$$

where  $t$  is the number of trading days during the holding period,  $HPR_m$  is the equally-weighted market index return over the same holding period.  $ALPHA$  is the intercept of the Fama-French-Carhart 4-factor model over the holding period using the daily pricing data from Pink Sheets.

	$HPR$	$MHPR$	$ALPHA$
Min(%)	-100.0	-86.5	-21.9
Median(%)	-88.6	-16.6	-0.8
Max(%)	2746.7	40.1	17.8
Mean(%)	-33.3	-16.6	-1.2
StdDev(%)	190.6	18.5	2.6
t-statistics	-4.3	-24.4	-11.2
Skewness	8.8	-0.4	-2.1
Kurtosis	105.6	1.4	23.3
N	609	609	609



**Table 7: Distribution Statistics of HPR and MHPR sorted by Price, Outcome and Delisting Time**

Distribution Statistics of *HPR* and *MHPR* sorted by Price, Outcome and Delisting Time. Initial price level of three sub-groups, (0, 0.1), (0.1, 0.5), (0.5, 10), are used as proxy for size of the company. Final outcomes are classified as either (1) Successfully Reorganized or (2) Others; and delisting time are classified as either (1) Delisted within holding period or (2) Others.

**Panel A Distribution Statistics of HPR sorted by Price, Outcome and Delisting Time**

	N	Mean (%)	Std(%)	Min(%)	Median(%)	Max(%)
Initial Price (\$1)	190	-31.6	219.5	-99.9	-73.2	2746.7
Resolution Outcome	263	-36.0	191.4	-100.0	-92.2	2130.8
	147	-37.4	133.8	-100.0	-93.1	995.6
	213	-0.4	220.3	-100.0	-64.5	2130.8
Successfully Reorganized	396	-51.0	170.3	-100.0	-94.0	2746.7
Others	282	-45.5	126.6	-100.0	-93.1	995.6
Delisting Time	327	-22.8	231.8	-100.0	-77.5	2746.7
Delisted within Holding Period						
Others						

**Panel B Distribution Statistics of MHPR sorted by Price, Outcome and Delisting Time**

	N	Mean(%)	Std(%)	Min(%)	Median(%)	Max(%)
Initial Price (\$1)	190	-16.4	18.9	-86.5	-14.2	31.8
	263	-18.6	17.9	-78.9	-18.3	40.1
	147	-16.8	17.9	-77.6	-16.8	34.7
Resolution Outcome	213	-13.5	19.4	-74.2	-13.9	40.1
Successfully Reorganized	396	-19.7	17.6	-86.5	-17.8	28.8
Others	282	-19.0	17.9	-80.7	-17.5	34.7
Delisting Time	327	-16.3	18.9	-86.5	-15.2	40.1
Delisted within Holding Period						
Others						

**Table 8: Explaining the Performance of Bankrupt Stocks—Excess Monthly Returns**

Coefficients and t-statistics (in parenthesis) of the following regression equation:

$$MHPR_i = \alpha + \beta_1^* Daily\_Spread_i + \beta_2^* Daily\_Volatility_i + Control\ Variables + \varepsilon_i,$$

where  $MHPR$  is the excess monthly return of the bankrupt stock over market return.  $Daily\_Spread$  is the daily percentage spread averaged over the Chapter 11 trading period.  $Daily\_Volatility$  is the daily highest price minus lowest price divided by the closing price averaged over the Chapter 11 trading period.  $DV(outcome)$  is the dummy variable of the final resolution outcome (1 if the firm is successfully organized, and 0 otherwise).  $DV(delisting\ time)$  is the dummy variable of the delisting time (1 if the stock is delisted within the Chapter 11 process, and 0 otherwise). Other control variables are defined in Table 3.

	Model 1	Model 2	Model 3
<i>Intercept</i>	-0.1277 (-11.08)	-0.1299 (-8.16)	-0.1395 (-4.45)
<i>Daily_Spread</i>	-0.0809 (-4.07)	-0.0692 (-3.34)	-0.0820 (-3.69)
<i>Daily_Volatility</i>	-0.0111 (-2.53)	-0.0105 (-2.41)	-0.0132 (-2.68)
<i>DV(outcome)</i>		0.0352 (2.16)	
<i>DV(delisting time)</i>		-0.0347 (-2.35)	
<i>Log(Total Assets)</i>			-0.0016 (-0.33)
<i>Leverage</i>			0.0046 (0.71)
<i>Tangible Ratio</i>			0.0355 (1.06)
<i>ROA</i>			-0.0127 (-0.98)
R-Square	5%	7%	7%
F-Value	15.15	10.31	6.56
N	571	571	505

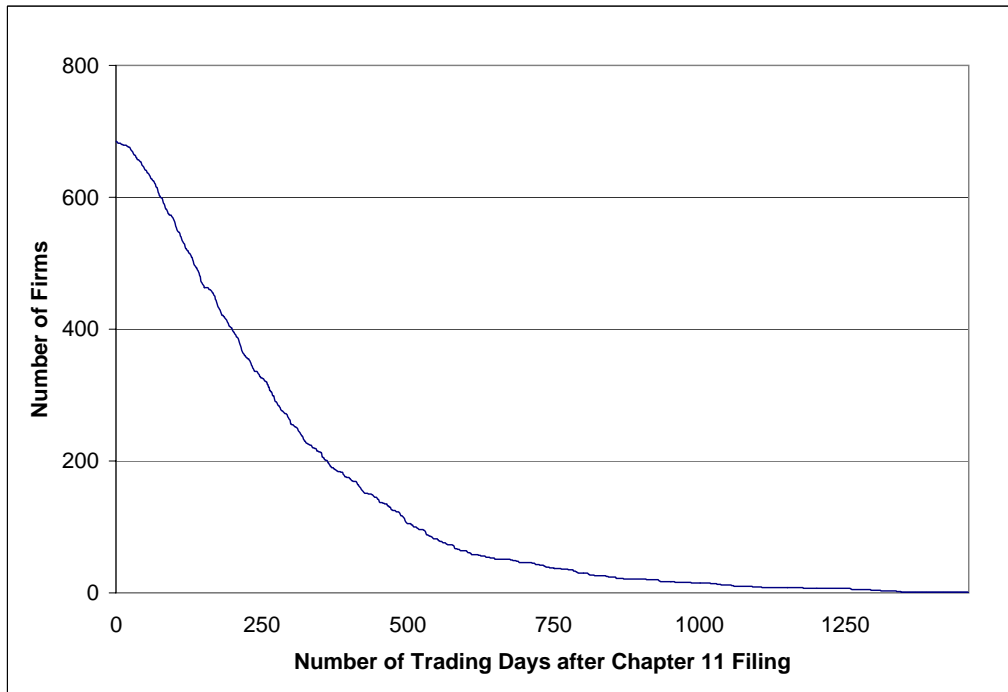
**Table 9: Explaining the Performance of Bankrupt Stocks—Alpha**

Coefficients and t-statistics (in parenthesis) of the following regression equation:

$$ALPHA_i = \alpha + \beta_1^* Daily\_Spread_i + \beta_2^* Daily\_Volatility_i + Control\ Variables + \varepsilon_i,$$

where  $ALPHA$  is the intercept of Fama-French-Carhart 4-factor model of each bankrupt stock.  $Daily\_Spread$  is the daily percentage spread averaged over the Chapter 11 trading period.  $Daily\_Volatility$  is the daily highest price minus lowest price divided by the closing price averaged over the Chapter 11 trading period.  $DV(outcome)$  is the dummy variable of the final resolution outcome (1 if the firm is successfully organized, and 0 otherwise).  $DV(delisting\ time)_i$  is the dummy variable of the delisting time (1 if the stock is delisted within the Chapter 11 process, and 0 otherwise). Other control variables are defined in Table 3.

	Model 1	Model 2	Model 3
<i>Intercept</i>	-0.0075 (-6.48)	-0.0075 (-4.72)	-0.0083 (-2.59)
<i>Daily_Spread</i>	-0.0049 (-2.48)	-0.0038 (-1.85)	-0.0050 (-2.21)
<i>Daily_Volatility</i>	-0.0013 (-2.96)	-0.0012 (-2.84)	-0.0013 (-2.57)
<i>DV(outcome)</i>		0.0034 (2.07)	
<i>DV(delisting time)</i>		-0.0037 (-2.48)	
<i>Log(Total Assets)</i>			0.0002 (0.44)
<i>Leverage</i>			0.0006 (0.95)
<i>Tangible Ratio</i>			-0.0032 (-0.94)
<i>ROA</i>			0.0001 (0.04)
R-Square	3%	5%	4%
F-Value	10.03	7.79	3.62
N	571	571	505



**Figure 1: Number of Firms Remaining in Chapter 11 after Bankruptcy Filing Day.**

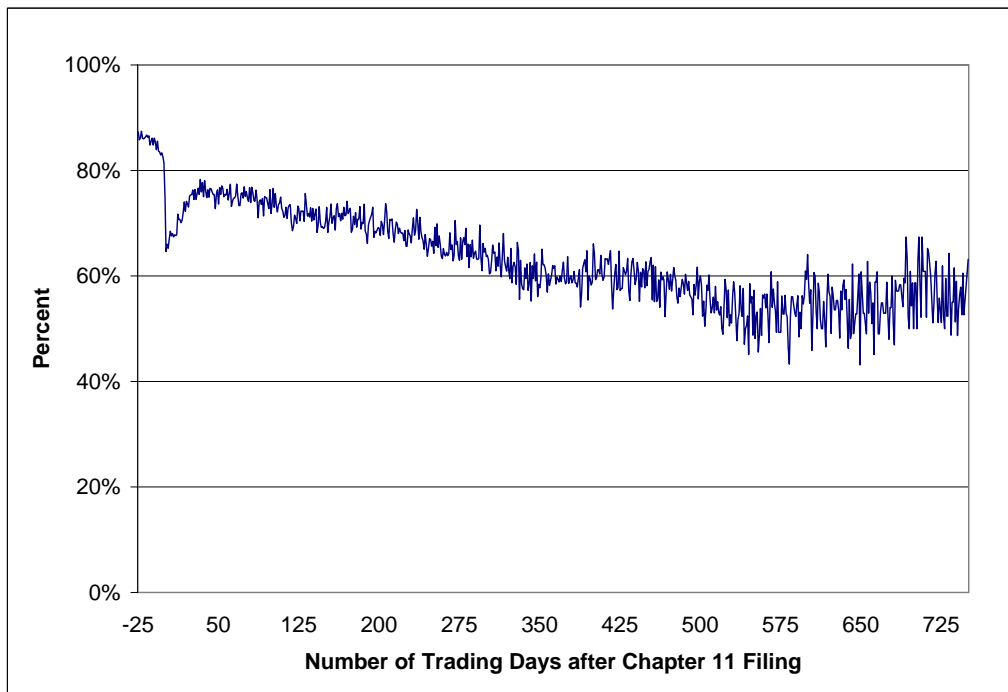
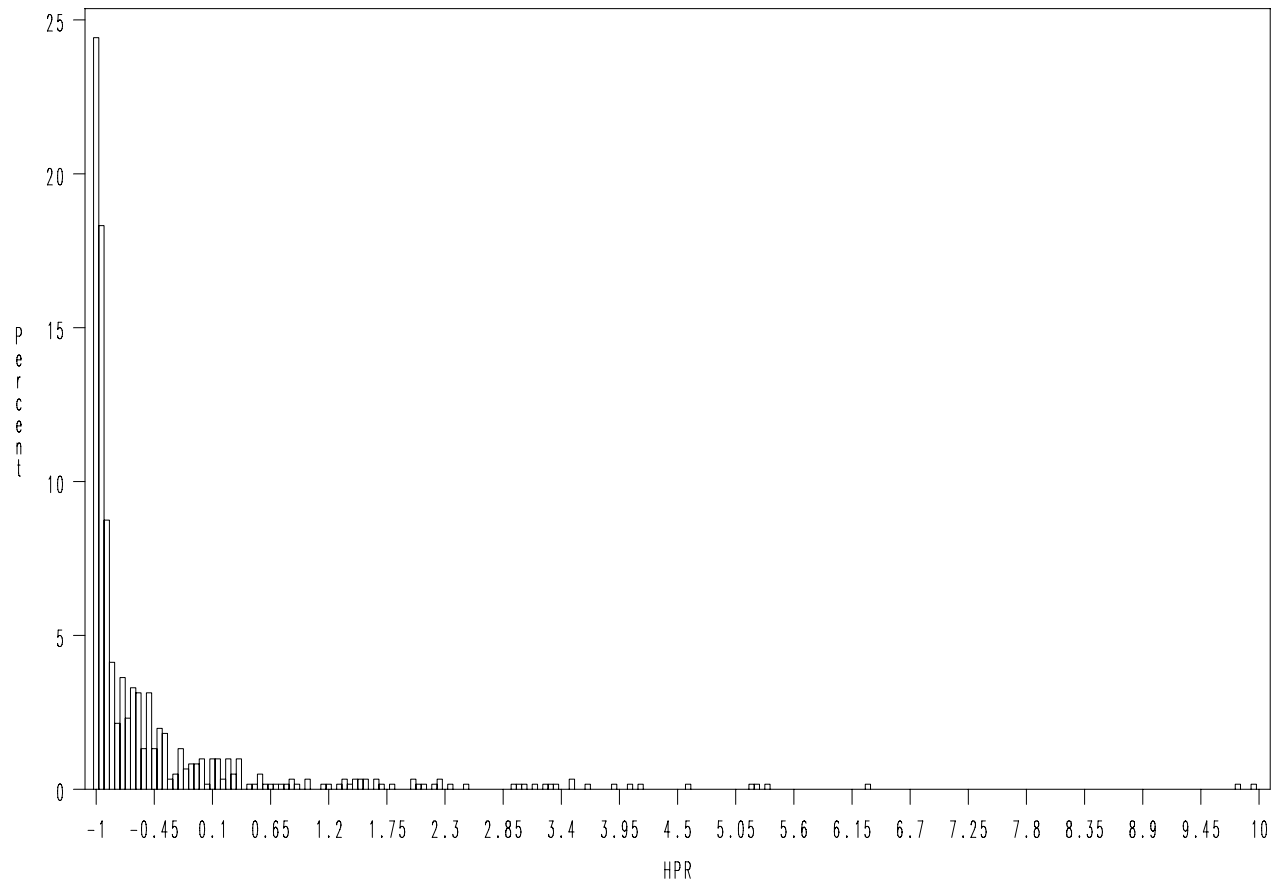


Figure 2: Percentage of Bankrupt Stocks Traded.

### Histogram of the Holding Period Return HPR



**Figure 3: Histogram of the Holding Period Return (HPR).**

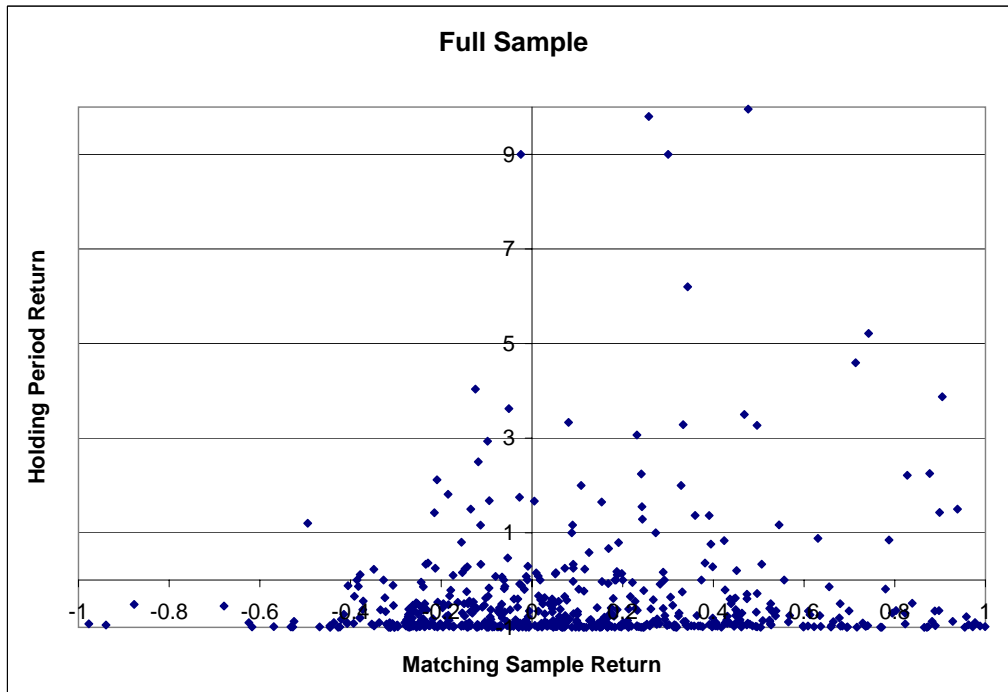


Figure 4: Holding Period Return of Bankrupt Stocks against Matching Sample Returns.

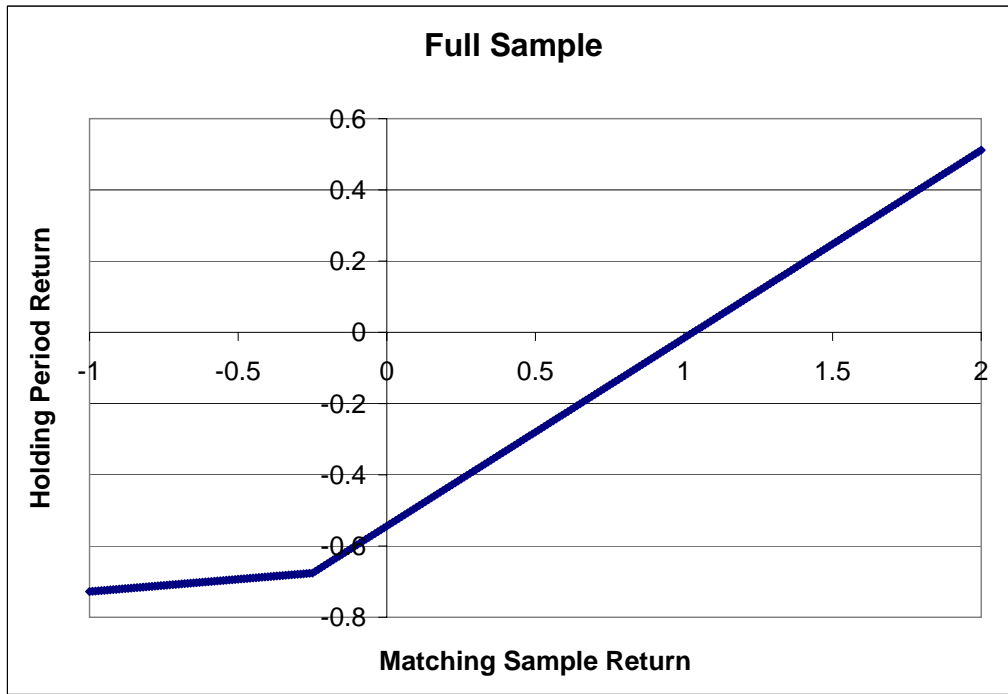


Figure 5: Piecewise Linear Regression of Bankrupt Stock Holding Period Returns on Matching Sample Returns.



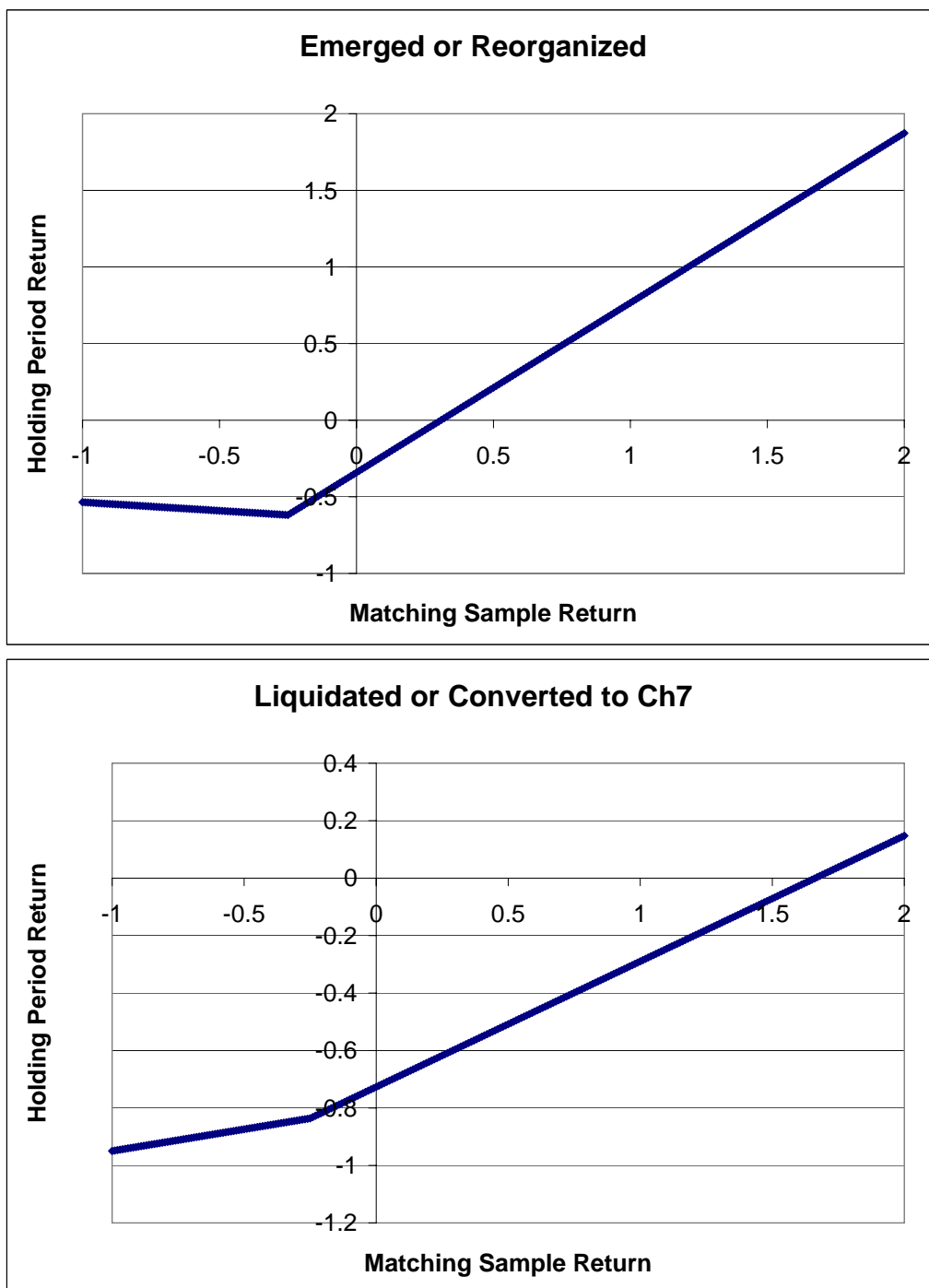


Figure 6: Piecewise Linear Regression of Bankrupt Stock Holding Period Returns on Matching Sample Returns for Two Sub-Groups.

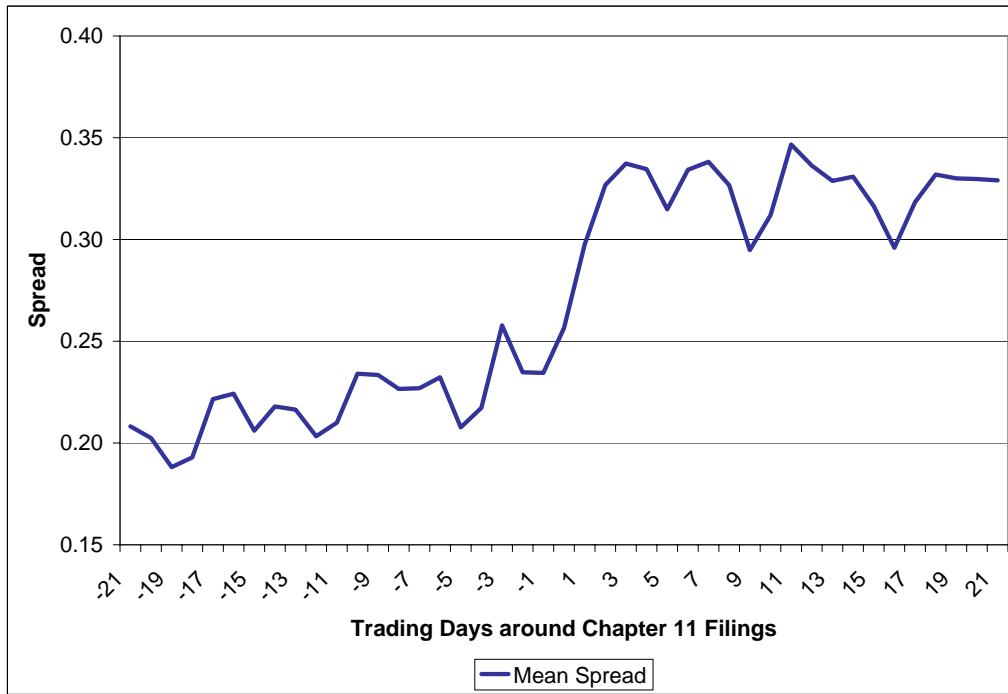


Figure 7: Average Quoted Spread 21 Trading Days before to 21 Trading Days after Chapter 11 Filings.