Gambling on the market: who buys the stock of bankrupt firms?

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ABSTRACT

This paper asks whether the stocks of bankrupt firms are correctly priced, and explores who trades the stocks of these firms, and why. Our sample consists of firms that enter into Chapter 11 and remain listed on the NYSE, AMEX, and NASDAQ post-filing. We show that these stocks are heavily traded by retail investors who are also their main stockholders. We further document that these stocks have unique lottery-like characteristics, and that retail investors trade in such stocks as if they were gambling on the market. Buying and holding such securities leads, on average, to a negative realized abnormal return of at least -28% over the 12 months after the Chapter 11 filing. However, we find that arbitrageurs are not able to exploit this market-pricing anomaly due to implementation costs, and high attendant risks. We thus conclude that a combination of gambling-motivated trading by retail investors, *and* limits to arbitrage, seems to lead to the anomalous results we document. Our paper thus provides an answer to the Fama-French recent question on their blog – "Bankrupt Firms: Who's Buying?".

Keywords: Post- Chapter 11 bankruptcy trading, gambling, lottery stocks, limits to arbitrage, retail investors

JEL classification: G14, G33

1. Introduction

There is an extensive literature that addresses a wide range of bankruptcy-related issues.[1] However, we still know very little about the trading environment and price dynamics of bankrupt firm stocks. Part of the reason is that 90% of the stocks of publicly-listed firms filing for Chapter 11 cease trading on the main exchanges at or before the filing date (Dawkins, Bhattacharya and Bamber, 2007).

Our study seeks to add to the literature in a number of ways. In particular, it responds directly to the recent question raised by Eugene Fama and Kenneth French, which is the title of this paper.[2] First, we investigate who trades the stock of bankrupt firms that remain listed on the main exchanges, and why, a novel topic within this literature. Specifically, we establish that retail investors are the main holders of these securities, and the most active traders. We also show that they trade these stocks *as if* they were playing a lottery. Second, we analyze what happens to the stock prices of firms that remain listed in the post-bankruptcy period, and observe a negative and statistically significant post-bankruptcy announcement drift of -28% over the following year. Finally, we document impediments that limit the arbitrage activity in this particular market such that arbitrageurs are not able to exploit this pricing anomaly. This helps explain why this "bankruptcy anomaly" is not arbitraged away, even in the longer run.

To date, to the best of our knowledge, no study has examined the clientele characteristics of the stocks of bankrupt firms in detail. This is an important issue particularly in the light of the recent spate of large bankruptcies.[3] In this paper, we show that trading in the stock of bankrupt firms seems to be driven by what Kumar (2009) portrays as gambling on the market by retail investors. Our findings also complement those of Han and Kumar (2009), who show that stocks with speculative features are the preferred habitat of retail (individual) investors

[1] For example, a recent survey by Hotchkiss, John, Mooradian and Thorburn (2008) cites more than 70 related research papers.

[2] In their blog, Fama/French Forum, Eugene Fama and Kenneth French specifically ask why bankrupt firms such as GM often trade well above zero, and whether this is an example of mispricing. In particular, they speculate on whether such stocks are rationally priced like out-of-the money call options, or whether reported prices are too high on average due to lack of investor rationality in a situation where arbitrage is difficult if not impossible. They also comment on the lack of studies of the in-bankruptcy performance of publicly traded stocks. See http://www.dimensional.com/famafrench/2010/02/qa-bankrupt-firms-whos-buying-1.html.

[3] E.g., CIT Group (11/01/2009), General Motors Corporation (06/01/2009), Thornburg Mortgage, Inc. (05/01/2009), Chrylser LLC (04/30/2009), General Growth Properties, Inc. (04/16/2009), Lyondell Chemical Company (01/06/2009), Washington Mutual (09/26/2008), and Lehman Brothers Holdings Inc. (09/15/2008). See http://www.bankruptcydata.com/Research/Largest_Overall_All-Time.pdf for more details.

with a strong propensity to gamble, and utility functions displaying risk-seeking behavior. Our results are, likewise, broadly consistent with the sensation seeking, and desire to trade for entertainment, explanations for such retail investor behavior of Dorn and Huberman (2010), Grinblatt and Keloharju (2009), and Dorn and Sengmueller (2009).

The market's anticipation of the bankruptcy event, and the stock price reaction to formal filing for Chapter 11, are well explored in the literature (e.g., Clark and Weinstein, 1983; Datta and Iskander-Datta, 1995; Dawkins et al., 2007), as is the market response to firm emergence from Chapter 11 (Eberhart, Altman and Aggarwal, 1999). However, there is a dearth of evidence on what happens to the stock price of firms that remain listed on the main exchanges *subsequent* to a few days after entering into bankruptcy proceedings (Altman and Hotchkiss, 2005, p.83; Dawkins et al., 2007). Morse and Shaw (1988) do discuss this to some extent, however, their early study uses a small sample of 56 firms and monthly data, and does not address the same questions as we do. The recent paper of Li and Zhong (2011) also explores some related issues, although their sample mainly consists of firms traded on Pink Sheets post-bankruptcy (over 90% of their sample). Moreover, their conceptual framework anchors on short-sale restrictions and heterogeneous beliefs. However, by focusing on firms that continue to trade on the NYSE, AMEX, and NASDAQ while in Chapter 11, we are able to concentrate on those stocks that, post-bankruptcy, should continue to be of interest to the financial media, professional analysts and, consequently, to a wide range of investors.[4]

In the last part of the paper we directly investigate the costs of arbitrage trading in bankrupt firm stocks, and the resultant limits to arbitrage. These costs of arbitrage trading severely limit trading by sophisticated investors such that the deviations of the prices of such stocks from those implied by the Efficient Market Hypothesis (EMH) may persist in the long-run. In the broader context, such effects have been documented by Taffler, Lu and Kausar (2004), Lesmond, Schill and Zhou (2004), and Kausar, Taffler and Tan (2009), among others.

Our main results can be summarized as follows. First, we establish that retail investors are particularly drawn to the stock of bankrupt firms. Specifically, we show that, as the bankruptcy date approaches, institutional (sophisticated) investors sell down their equity positions in the soon-to-be bankrupt firms, and that this tendency is dramatically amplified

[4] While in Chapter 11, all our sample firms still have to comply with the requirements of both the SEC and the exchange where their securities are listed. The same *does not* apply to firms traded on the Pink Sheets pre- and/or post-bankruptcy where there is no requirement to disclose financial or other company information. See http://www.pinksheets.com/pink/faq.jsp#3a for more details.

once bankruptcy is formally announced. For the typical case, retail investors end up owning an average of 90% of the firm's equity while bankruptcy is underway. We also show that retail investors trade more extensively on the stock of bankrupt firms than sophisticated investors do. For example, leading up to the Chapter 11 filing date well over 80% of trades are accounted for by retail investors compared with not much more than 2% by sophisticated investors. This disparity in number of trades is even more extreme post-bankruptcy. Over the 30-day period following the bankruptcy announcement date, retail investors' trades in the stock of the bankrupt firms account for 88.5% by number, compared with only 1.5% of trades by institutional investors, and this pattern does not change significantly over the following 11 months. In addition, we present evidence that the formal announcement of bankruptcy filing seems to render the stock of such firms even *more* attractive to retail investors, who are even stronger *net buyers* of the stocks of the firms we examine, while the opposite seems to occur in the case of sophisticated investors, who tend to be *net sellers* both leading up to, and post-Chapter 11 announcement.

We then examine the main characteristics of the stocks of bankrupt firms, and find that such securities are very similar to what Kumar (2009) defines as lottery-like stocks. These are low priced, and thus for a small initial investment offer a very low probability of a huge future reward, and a very high probability of a small loss. Kumar (2009) shows that poor, young, less educated single men who live in urban areas, undertake nonprofessional jobs, and belong to specific minority groups (African-American and Hispanic) tend to invest more in "lottery-type" stocks. Moreover, Han and Kumar (2009) show that such stocks with speculative features are the preferred habit of retail investors who exhibit a strong propensity to gamble. Thus, our results seem to indicate that gambling on the stock market at least partially explains why the stocks of failed firms continue to be actively traded by retail investors even after formal announcement of bankruptcy.

Next, we explore how the retail trading behavior we document impacts the stock price of bankrupt firms. In line with previous studies, we show that the stock price of firms filing for bankruptcy falls, on average, 26% over the three-day window surrounding the formal announcement date. More importantly, we find a highly significant post-bankruptcy drift of at least -28% over the following 12 months. This puzzling finding cannot be explained by other established phenomena, and it is also insensitive to a whole range of different implementations of event-study methods including calendar-time portfolio formation. The

negative return of -28% we document is inconsistent with any mean-variance asset-pricing model, and raises several important questions about the risk-return trade-off that is anticipated by investors in these stocks. Our evidence is, however, consistent with Kumar (2009), who reports that investors who invest disproportionately more in lottery-type stocks experience greater underperformance, and with Han and Kumar (2009), who find that stocks with high levels of retail trading earn low average returns.

Finally, we show that transaction costs severely hinder an arbitrageur's ability to intervene in the particular market we study, even absent such issues as the amount of capital that may need to be posted, and buy-in risk. Specifically, in the *best case* scenario a sophisticated investor may expect to lose at least 18.0% (11.2%) on average over a 6-month (12-month) period post-Chapter 11 filing when engaging in an arbitrage strategy involving bankrupt firms' stock. This helps explain why the post-bankruptcy drift we uncover is not eliminated by arbitrageurs.

To summarize, this paper documents the anomalous finding of a large negative realized return post-Chapter 11 filing, over and above the precipitous drop in stock price on the bankruptcy announcement date. We examine investor biases and limits to arbitrage as potential explanations for this result. As mentioned above, retail investors are the main shareholders and traders of firms in Chapter 11, with previous literature showing that such market participants are vulnerable to psychological biases that impair their ability to make rational investment decisions (e.g., Odean, 1998; Barber and Odean, 2000, 2001, 2002 and 2008; Hvidkjaer, 2008). Also, we show that bankrupt firms' stocks share a number of characteristics with stocks that are typically used by a clientele of unsophisticated investors who gamble on the stock market *as if* they were playing lotteries. In addition, we demonstrate that the high costs of conducting the required trades in the stocks of bankrupt firms renders such activities unattractive to arbitrageurs. We argue that it is the combination of gambling-motivated trading by retail investors, the main shareholder group, *and* limits to arbitrage, that explains the incomplete market reaction to the announcement of the Chapter 11 bankruptcy event we document.

Our results constitute additional evidence showing that the market has problems in correctly assimilating the implications of public domain bad news events (e.g., Bernard and Thomas, 1989, 1990; Michaely, Thaler and Womack, 1995; Dichev and Piotroski, 2001; Taffler et al., 2004; Kausar et al., 2009). Exploring the market's reaction to bankruptcy is

particularly interesting in this context since it is the most extreme and unambiguous bad news event in the corporate domain one can consider.

At a more general level, our paper may also help to shed light on the "distress anomaly" recently discussed by Campbell, Hilscher and Szilayi (2008) who show that financially distressed stocks deliver anomalously low returns inconsistent with standard models of rational asset pricing.

This paper proceeds as follows. The next section describes our data. In sections 3 and 4 we investigate who is trading the stock of bankrupt firms pre- and post-event, and why respectively. Next, we study stock price-performance before and after the Chapter 11 filing. In section 6 we explore the potential role of arbitrageurs in this context. Section 7 discusses our results, and section 8 concludes.

2. Data and descriptive statistics

This section summarizes our sample collection strategy and the key characteristics of our bankrupt and control firms.

2.1 Sample and control firms

Our data consists of the 351 nonfinance, nonutility industry firms which file for Chapter 11 between 01/10/1979 and 12/10/2005, and remain listed on the NYSE, AMEX or NASDAQ after their bankruptcy date.[5] Table 1 summarizes our sample construction strategy, with all phases being sequential. In the first step all firms filing for bankruptcy between 1979 and 2005 are identified. Seven sources of data are used for this purpose: 1) the Bankruptcydata.com database;[6] 2) the SEC's Electronic Data Gathering, Analysis, and Retrieval system (EDGAR);[7] 3) COMPUSTAT's industrial file; 4) Professor Lynn Lopucki's Bankruptcy Research database;[8] 5) the SDC database; 6) Altman and Hotchkiss (2005, pp.15-

5 Bankruptcies in the U.S. were governed by the Bankruptcy Reform Act of 1978 between 10/01/1979 to 10/17/2005. In 2005, this Act was substantially revised by the Bankruptcy Abuse Prevention and Consumer Protection Act. Although most of the provisions of the new Act affect consumer bankruptcies, it also had an important impact on corporate bankruptcy as, in general, the new code treats the creditors of bankrupt firms more favorably than its predecessor (Altman and Hotchkiss, 2005, p.47). Accordingly, restricting our analysis to the 10/01/1979 to 10/17/2005 period limits the impacts of the changes in legal setting on our results.

6 See http://www.bankruptcydata.com/.

7 Companies filing for bankruptcy are required to report this to the SEC within 15 days using Form 8-K. Accordingly, to find the bankruptcy cases reported on EDGAR, we search and manually analyze all 8-K forms available on EDGAR that mention the keywords "bankruptcy", "Chapter 11" or "reorganization".

8 See http://lopucki.law.ucla.edu/.

20), and 7) a list of bankrupt firms provided by Professor Edward Altman. Firms are combined into a single list and duplicates removed, yielding a total of 3,437 nonoverlapping cases.

Table 1 here

Firms are next located on the *Center for Research in Security Prices* (CRSP) database leading to 1,411 firms being eliminated, the main reason being that firms could not be found in CRSP. However, a few other cases are also excluded because the firm's ordinary common stock (CRSP share code 10 or 11) is not traded on a major U.S. stock exchange (CRSP exchange codes 1, 2 or 3) during this period, or the firm does not have at least 24 months of pre-event returns available on CRSP.

In the next step, the 1,556 firms delisted prior to or at their bankruptcy filing date are deleted. From the 470 surviving cases, the 58 firms for which accounting data is not available on COMPUSTAT for a 2-year period before the bankruptcy announcement year are then removed, together with 11 firms incorporated outside the U.S. (as defined by COMPUSTAT). Penultimately, following prior research, we also remove all 40 financial and utility firms from our final sample.[9] The 10 firms filing for Chapter 7 are then finally excluded in the last step of the screening process.

Our 351 sample firms have 53 different two-digit SIC codes (168 different four-digit codes) indicating no significant degree of industry clustering. Sixty percent of our firms trade on the NASDAQ (209), 31% (109) on the NYSE, and the remaining 9% (33) on the AMEX.

We also construct a sample of control firms by matching each of our sample firms with the firm with most similar size, and book-to-market ratio (e.g., Dichev and Piotroski, 2001; Taffler et al., 2004; Kausar et al., 2009).[10] First, for each sample firm, market capitalization is measured one month before the bankruptcy filing date.[11] CRSP is then searched for an initial

[9] Utility firms are generally regulated enterprises leading to bankruptcy having a different meaning, and financials have dissimilar characteristics to industrial firms with Chapter 11 applying differently. Financial and utility firms are defined as in the 49 industry portfolios available at Professor Kenneth French's website. See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_49_ind_port.html.

[10] The results of our analysis are very similar if we use control firms matched on size and momentum, industry and stock-price, size and z-score, and industry, size and book-to-market.

[11] As a robustness check, we measure size for all sample firms one, three, six and 12 months before their bankruptcy date and re-run our analysis. Results do not change. In all cases, the market value of every sample firm is measured before its bankruptcy announcement date. This is confirmed by manually inspecting all cases.

pool of matching candidates with market capitalization of 70% to 130% of the sample firm's equity value. The control firm is then identified as that firm within this set with closest book-to-market ratio and the match is confirmed if: 1) the matched firm has at least 24 pre-event months of returns available on CRSP; 2) is not in bankruptcy; 3) is incorporated in the U.S.; 4) is not a financial or utility firm, and 5) it has sufficient information on COMPUSTAT to conduct our analysis.

2.2 Descriptive statistics

Table 2 provides sample and control firm descriptive statistics. Panel A shows that our sample firms are severely financially distressed before filing for Chapter 11. For the typical firm, return on assets is negative (mean=-19%, median=-6%), current ratio is low (mean=169%, median=128%), and leverage is relatively high (mean=45%, median=40%). Not surprisingly, the average Altman (1968) z-score is low (mean=1.37, median=1.31), suggesting that these firms are likely to fail. Results for control firms are somewhat different. For instance, even though matched on size and book-to-market these businesses are in a stronger financial position than the bankrupt sample. Mean and median z-score, and current ratio are higher, and leverage is appreciably lower (differences between groups are statistically significant at the 1% level). Nonetheless, the typical control firm is also losing money: mean return on assets is -14.8%, with the corresponding median not significantly different from zero at conventional levels. Panel A also shows bankrupt and control firms have similar total assets and sales.

Table 2 here

Panel B of Table 2 summarizes a number of market variables. Both sample and control firms are small, with average market capitalization of around $160m (median=$32m) and have high book-to-market ratios. Panel B also shows that, despite their small average size, our bankrupt firms trade on average for 230 days (out of 252) in the 12-month period *following* the bankruptcy announcement month. In the comparable period, control firms trade for an average of 224 days, with difference in means significant at a 10% level. This suggests that the stock of bankrupt firms is of interest to some investors, a point also raised by Hubbard and Stephenson (1997). Panel B also highlights the very significant impact of the

bankruptcy filing on the mean stock price, which falls from $4.97 before the event to $2.08 in the event month, a reduction of almost 60%. The equivalent decline in the median price is from $3.12 to $0.97. For the 12-month period post the Chapter 11 filing month equivalent mean and median stock price are $2.98 and $0.71 for those firms remaining listed. In the case of the control firms, prices remain relatively stable, with a mean value of around $9 (median around $5) across the full 25-month period.

Panel B of Table 2 again shows that there is a market for the stock of bankrupt firms. In fact, in the 12 months before the bankruptcy date, average daily turnover for these firms is 0.51%, implying an annual turnover rate of 130%. This rate spikes to 290% in the bankruptcy-announcement month, which shows the importance of the event under analysis to investors. After this initial effect dissipates, mean bankrupt firm daily turnover stabilizes at 0.57%, equivalent to an annual rate of 145%. The data also shows that the reported pattern is specific to our event firms; in the case of the control sample, daily turnover does not exhibit any obvious variation, with a mean value of around 0.43% over the entire period.

Panel B of Table 2 shows that investors face large bid-ask spreads when trading the stock of bankrupt firms. In the pre-event period, mean estimates vary between 5.8% and 8.3% (median values range from 5.2% to 6.9%). Post-event, the mean bid-ask spread estimates vary between 8.9% and 12.5% (median values range from 6.6% and 10.7%). This sharp increase in the bid-ask spread seems to be driven by the announcement of Chapter 11. In fact, panel B of Table 2 shows that for our size and book-to-market control firms the equivalent mean (median) estimate for the bid-ask spread is between 3.8% and 6.3% (3.0% and 4.3%) in the pre-event period, and an effectively unchanged 3.9% and 7.2% (2.6% and 4.4%) post-event. As a robustness test, we also estimate the all-in (explicit and implicit) roundtrip cost of trading in our sample and control firms using the LDV model of Lesmond, Ogden and Trzcinka (1999). Results are consistent with those reported above: both in the pre- and post-event period, bankrupt firms exhibit significantly higher round-trip transaction costs than their benchmark firms. Pre-Chapter 11 mean (median) bankrupt firm LDV roundtrip cost is 11.2% (8.9%) compared with 9.0% (6.9%) for our control firms; post-bankruptcy, the equivalent mean (median) figures are 14.5% (12.3%) and 10.4% (8.3%) respectively.

Finally, panel C of Table 2 shows that only 25% of our sample firms have positive earnings, and around the same percentage pay dividends. In line with panel A, panel C again presents evidence that control firms are financially stronger than sample firms. Almost 50%

of the former have positive earnings, and around 40% pay dividends. Around a quarter of the bankrupt firms have a first time going-concern audit opinion in their accounts for the fiscal year preceding Chapter 11. Only two percent of the control firms are in the same situation.

3. Who trades bankrupt stocks: institutions or individuals?

Bankrupt firms are special. On the one hand, their equity should be attractive to vulture funds which specialize in trading distressed securities such as bonds in or near default, and equities that are in or near bankruptcy (Rosenberg, 2000). In theory, hedge funds should also be drawn to this type of security. Lhabitant (2006, pp. 230-231) explains that some hedge funds employ an investment strategy that entails taking a large equity position in a bankrupt firm and, at the same time, buying its outstanding debt. This ensures that the hedge fund is in command of the reorganization process, which improves the odds of maximizing its total payoff.

On the other hand, retail investors may also be interested in bankrupt firms' stock. As argued by Russel and Branch (2001), such investors may wrongfully perceive a considerable potential for price appreciation, which is motivated by the fact that these securities usually trade at very low prices. Information available on the SEC's website supports this idea: "*(…) Investors should be cautious when buying common stock of companies in Chapter 11 bankruptcy. It is extremely risky and is likely to lead to financial loss. (…)* ***In most instances, the company's plan of reorganization will cancel the existing equity shares***." [emphasis in original.][12] The SEC's 2003 annual report further informs readers (p. 33): "*During 2003, we received numerous complaints from investors who purchased stock in bankrupt companies under the mistaken belief that the stock price would rise when the company emerged from bankruptcy. In each case, however, the company had announced in its plan of reorganization its intention to cancel its existing common stock and to issue new stock."* We speculate the SEC has made an effort to clarify the dangers of investing in bankrupt firms' stock because of its concern that whoever is trading in this type of security may not fully understand the risk she is taking. This implies the SEC recognizes retail investors are an important component of this particular market.

[12] See http://www.sec.gov/investor/pubs/bankrupt.htm for details.

3.1 Stockholdings of bankrupt firms

In this section we investigate who, in the typical case, owns the stock of firms approaching, and during Chapter 11 bankruptcy reorganization. We do this by examining how the stockholdings of institutional investors in bankrupt firms change through time. As Nofsinger and Sias (1999) point out, the fraction of shares held by institutional investors is one less the fraction of shares held by individuals, and thus studying the variation in institutional stockholdings is the counterpart of studying the stockholdings of individuals. We gather the information relating to institutional holdings from the Thomson Financial Network CDA/Spectrum 13F Institutional holdings file. The data covers our entire sample period, beginning in the first quarter of 1980 and ending in the last quarter of 2006. We use the same source to collect data for our size and book-to-market control firms.

We compute institutional stockholdings as follows (e.g., Nofsinger and Sias, 1999):[13]

$$Inst_{i,q} = {Shares\,held_{i,q}} \Big/ {Shares\,outstanding_{i,q}} \qquad (1)$$

where $Shares\,held_{i,q}$ is the number of shares of firm i held by institutional investors at quarter q, and $Shares\,outstanding_{i,q}$ is firm i's number of outstanding shares at quarter q. For firm i, quarter 1 is the first post-Chapter 11 quarter for which institutions have to report their stockholdings to the SEC.

Table 3 summarizes our results. We find that in event-quarter -8 institutions own, on average, 24% of our sample firms' stock (median holdings are 20%). Four quarters later, they own, on average, 21% of these firms' shares (median holdings are 16%). After Chapter 11 filing (quarter 1) institutional investors own, on average, only 12% of these firms' shares, a pattern that remains effectively unchanged across the following three post-event quarters (institutions' median holdings are 8% in quarter 1, decreasing to 6% three quarters later). Parametric t- (and nonparametric Wilcoxon-Mann-Whitney) tests for differences in

13 Insiders' holdings in bankrupt and control firms are also derived using a parallel approach to that for institutional holdings, and Thomson Financial Network Insider filing data. However, there are problems with this data source (e.g., Lakonishok and Lee, 2001; Frankel and Li, 2004). In addition, as database coverage only starts in 1986, and even then is not complete, an important percentage of our sample cases are not covered. As such, we are forced to treat such analysis as only indicative. Nonetheless, for that subset of firms where we are able to obtain insiders' holdings data, 8 quarters before the bankruptcy date, mean (median) holdings are 8.6% (3.5%), with equivalent figures four quarters prior to bankruptcy 7.1% (3.4%). Immediately post-filing, insiders hold 7.0% (2.5%) of the stock of bankrupt firms, with proportions unchanged in quarter 4 (7.0% [2.2%]).

institutional holding levels before and after bankruptcy show significant differences (at the 1% (1%) level) between quarters -8 and 1, and quarters -4 and 1, but no change in the post-bankruptcy period. This suggests that institutions reduce their equity positions in soon-to-be bankrupt firms as the Chapter 11 date approaches, and maintain their lack of exposure to these firms at least for the following four post-event quarters.

Table 3 here

Previous research shows that institutional investors dislike small firms' stock (e.g., Gompers and Metrick, 2001) and, as such, the above results may not be specific to bankrupt firms. Table 3, however, suggests otherwise. In event-quarter -8, institutions own on average 24% of our control firms (median holdings are 19%), identical to that for our bankrupt firms. However, by event-quarter -4, the mean (median) difference between sample and benchmark firms is around 5% (5%), and significant at normal levels. This divergence in institutional holding proportions increases steadily with time so that by quarter 1 (immediately post–bankruptcy), whereas institutions still own, on average, 23% of control firms' shares (median holdings are 18%), they now only hold 12% of the bankrupt firms' stock (median holdings are 8%) as pointed out above. Mean and median differences between groups are significant at better than the 1% level, with the same pattern applying in the following three quarters.[14]

Two main ideas summarize our findings: 1) institutional investors steadily sell down the stock of subsequently bankrupt firms as the Chapter 11 date approaches; 2) once bankruptcy is underway, their participation in the market for bankrupt firms is, at best, marginal. An alternative, and perhaps more interesting, way to read our results is to realize that retail investors own, on average, around 90% of the stock of firms undergoing Chapter 11 reorganization. As such, they are likely to be the marginal investors in this particular market, and thus setting bankrupt firms' stock prices.

3.2 Who trades the stock of bankrupt firms?

At best, our previous analysis can only provide *indirect* evidence about who is actually *trading* the stock of bankrupt firms. This section addresses this issue directly by

[14] Control firm mean (median) insider holdings, derived on the same basis as with our sample firms, are 13.5% (9.5%) across the 12-quarter period we observe, with no significant change over time.

implementing three tests that employ actual trading data collected from the Trade and Quotes (TAQ) database. Our tests are based on the period that runs from 1993 to 2000 because: 1) the TAQ database first becomes available in 1993, and, 2) in 2001, the widespread introduction of decimalization and order-splitting by institutions (due to lower trading costs) profoundly affected the distribution of trade size (e.g., Hvidkjaer, 2008; Han and Kumar, 2009). This had a dramatic negative impact on the accuracy of existing methods for distinguishing between informed and noninformed trades, a key issue in our analysis.

In all our tests, we follow Lee and Radhakrishna (2000) and Barber, Odean and Zhu (2009), and use trade size to distinguish between trades initiated by sophisticated investors, and trades initiated by unsophisticated retail investors. In particular, trades less than $5,000 (SMALL) are used to proxy for retail investor trades, while trades greater than $50,000 (LARGE) are used as a proxy for institutional trades.[15] Consequently, our test ignores medium-size trades, which helps increase the statistical power of our tests (Lee and Radhakrishna, 2000). Moreover, as Chakravarty (2001) shows, sophisticated investors may use medium-size trades to avoid revealing their private information. Thus, considering medium-size trades in our analysis would reduce our ability to successfully separate trades initiated by retail investors from those initiated by sophisticated investors.

3.2.1 Initial evidence

We start by analyzing the trading behavior of sophisticated and retail investors in the stock of bankrupt firms by computing the following measures:

$$SMALL_{i,t} = STRI_{i,t} / TOTAL_{i,t} \tag{2}$$

and,

$$LARGE_{i,t} = STSI_{i,t} / TOTAL_{i,t} \tag{3}$$

where $STRI_{i,t}$ ($STSI_{i,t}$) is the number of trades of retail (sophisticated) investors, defined as above, in the stock of firm i during event-month t, and $TOTAL_{i,t}$ is the total number of trades in firm i during event-month t. For firm i, each-event month is defined as a 21

[15] In unreported results, we classify transactions of 500 shares or less as small trades, and transactions of 3,000 shares or more as large trades. Results are very similar to those reported below, and are available from the first author.

trading-day period counted from the bankruptcy announcement date. We compute the two measures for a total of 24 event-month periods centered on the bankruptcy announcement date.

Table 4 provides the pooled time-series for our SMALL and LARGE measures. As can be seen in panel A, in event month -12, retail (sophisticated) investors are responsible for around 61% (7%) of all the trades in the stock of bankrupt firms. Put differently, 12 months before the Chapter 11 filing date, the volume of retail investor trades in these stocks is 9 times that of sophisticated investors. Panel A of Table 4 also shows that the relative weight of retail investors' trades in subsequently bankrupt firms' stock increases almost monotonically as the Chapter 11 date approaches. As a result, in event month -1, such investors' trades account for 86% of all the trades in such stocks. Panel A of Table 4 shows a different pattern when we consider sophisticated investors' trades. From event month -8 onwards, the percentage of trades accounted for by such investors decreases monotonically as the bankruptcy date approaches and, by the event month, these investors are responsible for only 1.9% of the total number of trades in the stock of the soon-to-be-bankrupt firms. In other words, in event month -1, retail investors trade the stock of bankrupt firms 44 times more than do sophisticated investors.

Table 4 here

Panel B of Table 4 shows that the Chapter 11 announcement event seems to increase further the relative propensity of retail investors to trade in the stock of bankrupt firms. In fact, in the first post-event month, retail investors are responsible for 89% of all the trades in such firms, trading almost 58 times more than sophisticated investors. Time does not seem to reduce retail investors' predisposition to trade in the stock of bankrupt firms. In fact, up until event-month 4, the relative weight of retail investors' trades never drops below 80% and after that, such investors' trades still account for around 70%-80% of all trades made in those bankrupt firms for which data is available on TAQ until event month 12. Panel B of Table 4 also shows that sophisticated investors continue to be reluctant traders in the stock of bankrupt firms post-event. In fact, in the first three event months after formal announcement of Chapter 11, the number of trades of such investors represents less than 2% of all the trades in the stock of our sample firms, and is not much higher over the following 9 months. This

compares with the monthly average of 5% of all trades in the stocks of these firms accounted for by sophisticated investors in the pre-event period.

3.2.2 The nature of investor trading in the stocks of bankrupt firms

So far we have shown that individual investors trade the stock of bankrupt firms considerably more than sophisticated investors do both before and after the bankruptcy announcement date. However, we also need to establish whether retail (and sophisticated) investors are mainly net buyers or sellers of these particular stocks. This is an important issue as it can shed light on the overall sentiment governing the nature of the trading activity of the two types of investors in the stocks of the highly distressed firms we address.

To explore this issue, we follow the approach of Lee and Ready (1991) and classify all the trades by our retail and sophisticated investors as either buyer or seller initiated. Next, we compute the relative weight of each type of trade for both categories of investor separately for the four pre- and post-event quarters centered on the bankruptcy announcement date.

Table 5 summarizes our results. Panel A shows that, in the pre-event period, retail investors are *net buyers* of the stock of bankrupt firms. In fact, the percentage of retail investors' trades in such securities classified as buys always exceeds the percentage of trades classified as sells at statistically significant levels. For example, in the last pre-event quarter, retail investor buy trades are no less than 12% greater than their sell trades, with 50.4% of trades classified as buys, and 45.0% of trades as sells. The test for difference in proportions is significant at better than the 1% level. Panel B of Table 5 shows that retail investors' predisposition to buy the stock of bankrupt firms even seems to increase with the formal announcement of Chapter 11. In the first post-event quarter, buys exceed sells by no less than 29%, with 52.9% of the trades of such investors classified as buys, and only 41.0% classified as sells. The test for difference in proportions is again significant at the 1% level. This pattern of retail investor trades continues, on a more attenuated basis, into the second post-bankruptcy quarter.

Table 5 here

Table 5 also presents the results for sophisticated investors. Panel A shows that, in comparison to retail investors, in the pre-event period, sophisticated investors are *net sellers*

of the stock of the soon-to-be-bankrupt firms. In all quarters the proportion of trades classified as sells always exceeds the proportion of trades classified as buys with differences all statistically significant at the 1% level. Panel B of Table 5 shows that this trading behavior is even more pronounced after bankruptcy is formally declared with first quarter post-Chapter 11 trades by sophisticated investors classified as sells no less than 18% higher than those classified as buys (49.9% sells, 42.4% buys). A related pattern of trades also continues, on a more attenuated basis, into the second post-bankruptcy quarter.

4. Why are the stocks of bankrupt firms so actively traded?

Panel B of Table 2 shows that the stocks of bankrupt firms that remain listed on the main exchanges post-Chapter 11 filing are heavily traded, with average annual trading volumes of 130% and 145% pre- and post-Chapter 11 filing, respectively. The results of Section 3 clearly suggest that a large proportion of such trading is driven by retail investors. In addition, Section 3 also shows that such unsophisticated investors become key once bankruptcy is underway as, in the typical case, they own around 90% of the stock of the failed firms. In this section we answer the basic question: why should anyone be interested in trading bankrupt firm stock anyway?

The extant literature speculates there are two main reasons for doing so. On the one hand, trading the stock of bankrupt firms may be a fully rational investment decision. As Merton (1974) suggests, bankrupt firm equity is a deep out-of-the money option.[16] In this way, investors buy bankrupt stocks just as they buy call options. Tax-related reasons may also explain why someone may rationally decide to purchase bankrupt firms' stock as investors can offset capital gains with the losses they make on these securities.

On the other hand, investor irrationality may also explain the trading in the stock of bankrupt firms. On 10 June 2009 Tom Petruno provides an excellent characterization of this situation, when writing for the *Los Angeles Times*:

> *"General Motors Corp. filed for bankruptcy protection, got kicked off the New York Stock Exchange and out of the Dow Jones industrial average. And its stock has mostly been rising ever since. In fact, GM has been one of the hottest issues on Wall Street over the last six trading sessions, surging from 61 cents to*

[16] Eugene Fama also speculates on this in his blog with Kenneth French. See http://www.dimensional.com/famafrench/2010/02/qa-bankrupt-firms-whos-buying-1.html.

today's closing price of $1.59 in the electronic pinksheets.com market - a gain of 161%. (…) As I've written before, there's a universe of traders out there who love to play around with big-name stocks that end up in bankruptcy. You can't explain the action based on any fundamentals. It's just a minute-to-minute, hour-to-hour trading game. (…) We know how this will end. But between now and then, for some gamblers playing GM is better than a trip to Vegas."[17] Tom Petruno words are even more striking when one realizes that in the same day GM issued a press release stating: "*GM management has noticed a recent elevation in the volume and price of its common stock. While GM does not control the market or its stock price, GM management strongly believes that any recovery for the common stockholders in the Chapter 11 bankruptcy process is highly unlikely, even under the most optimistic of scenarios."*

In his recent paper, Kumar (2009) studies the impact of the well-known human propensity to gamble on investment decisions. He focuses on stocks resembling lottery-tickets, i.e., "(…) that for a very low cost (…) offer a tiny probability of a huge future reward and a large probability of a small loss (…)" (Kumar, 2009, p.1890). Specifically, Kumar (2009) finds that the gambling preferences of a relatively less sophisticated retail investor clientele are, in fact, reflected in their stock investment decisions. Bankrupt firms' stock possesses the key characteristics of Kumar's (2009) lottery-like stocks. First, such securities usually trade at a very low price (e.g., Clark and Weinstein, 1983; Hubbard and Stephenson, 1997; Dawkins et al., 2007). Second, buying these firms' stock offers the possibility of engaging in a gamble with two extremes outcomes. On the one hand, investors may end up losing all of their investment if the firm is liquidated (e.g., Hubbard and Stephenson, 1997). In general, this is the most probable outcome. On the other hand, investors may be richly rewarded for their investment strategy, which eventually happens if the firm is able to emerge successfully from Chapter 11.[18] This is a rarer outcome. Importantly, the very low market price that characterizes this type of stock makes it possible for investors to earn extremely generous short-term returns when prices appreciate only a few cents. Consequently, it is possible that

[17] See http://latimesblogs.latimes.com/money_co/2009/06/general-motors-corp-filed-for-bankruptcy-protection-got-kicked-off-the-new-york-stock-exchange-and-out-of-the-dow-jones-i.html for further details.

[18] Hubbard and Stephenson (1997) show that pre-existing shareholders are rarely left with nothing when the firm emerges from bankruptcy. Additionally, Eberhart et al. (1999) report large, positive excess stock returns in the 200-day post-emergence period.

the stock of bankrupt firms attracts a number of investors who trade this type of security *as if* they are playing lotteries.

We test this conjecture by replicating Kumar's (2009) Table 2 using data from our sample and control firms for both the pre- and post-event period.[19] The rationale is twofold. First, we want to test more formally the extent to which our bankrupt firms have characteristics similar to those of Kumar's (2009) lottery-type stocks. Second, we need to investigate if such characteristics are specific to our sample firms, or are also common to our control firms.

Table 6 summarizes our results. Kumar (2009) uses three stock characteristics to define a lottery-like stock. The first is stock price, with Kumar (2009) arguing that lottery-like stocks should be relatively cheap. This is because, like lotteries, if investors are searching for cheap bets, they should naturally gravitate towards low-priced stocks. Table 6 shows that our sample firms' mean stock price in the pre-bankruptcy period is $4.97 dropping to $2.98 in the post-event period. Kumar (2009) reports that his mean lottery-stock price is $3.83. As such, post-event, our bankrupt firms are even *cheaper* on average than those classified by Kumar (2009) as lottery-stocks. In comparison, Table 6 shows that the mean stock price of our control firms is $9.80 in the pre-event period, and $8.84 in the post-event period (with both differing significantly from the respective bankrupt firm mean prices at the 1% level). So, on average, our bankrupt firms are also *cheaper* than our control firms.

Table 6 here

Idiosyncratic skewness is also used by Kumar (2009) to define his lottery-like stocks. He reasons that investors are likely to be attracted more towards stocks that *occasionally* generate extreme positive returns not related to market movements. In other words, investors are likely to find stocks with high positive stock-specific skewness attractive. Table 6 shows that in the pre-event period our sample firms' mean idiosyncratic skewness coefficient is 0.2, which is lower than the 0.7 reported by Kumar (2009) for his lottery stocks. However, post-event, this increases dramatically to 0.9, a figure actually higher than that of Kumar. Importantly, although the mean idiosyncratic skewness coefficient for our control firms is 0.5

[19] We report results for our size and book-to-market control firms. However, our findings are essentially identical when our control firms are benchmarked on size and momentum, industry and stock-price, size and z-score, and industry, size and book-to-market.

in the pre-event period, it is 0.7 post-event, significantly lower, at the 1% level, than for our bankrupt firms. So, on average, our bankrupt firms also have higher idiosyncratic skewness than our control firms post-Chapter 11 filing.

Finally, Kumar (2009) argues that stocks with higher idiosyncratic volatility are more likely to be perceived as akin to lottery tickets since investors might believe that the extreme return events observed *in the past* are more likely to be repeated when idiosyncratic volatility is high. Table 6 shows that in the pre-event period, mean idiosyncratic volatility of our bankrupt firms is 8.2, increasing to 12.5 post-event, and for our control firms 4.7, rising to 5.1 post-event (both differences significant at the 1% level). These coefficients compare with a value of 75.6 in the case of Kumar. However, as Kumar explains, high idiosyncratic volatility is only important because it may lead investors to amplify their perception of skewness. This would be especially true if they adopt an asymmetric weighting scheme and assign a higher weight to upside volatility, and ignore or assign a lower weight to downside volatility. As mentioned above, in the post-event period, the mean idiosyncratic skewness that we find for our sample firms is even higher than for Kumar's set of lottery-like stocks. As such, the lower idiosyncratic volatility that we find for our bankrupt firms simply reflects investors assigning a *lower* probability of an extreme positive return occurring in our sample firms than with Kumar's (2009) lottery-stocks. This is perfectly reasonable: after all, our firms are bankrupt.

In a nutshell, our bankrupt firm stocks seem to fit well with Kumar's definition of lottery stocks. As such, we would expect them to appeal to a range of retail traders to satisfy their need to gamble on the market. Hence, the human propensity to gamble seems to be able, at least partially, to explain why the stocks of bankrupt firms continue to be actively traded by retail investors even after the formal announcement of bankruptcy.

Our results are also consistent with Han and Kumar (2009), who study the relation between stock characteristics, and level of retail trading. Inspection of their Table 1 shows that the average firm in their highest retail trading decile has idiosyncratic volatility of 41.5, idiosyncratic skewness of 0.8, and a price per share of $2.97. Post-event, our bankrupt firms have very similar values on these measures of 12.5, 0.9, and $2.98, respectively. Han and Kumar conclude that stocks with speculative features, i.e., high idiosyncratic skeweness and volatility, and low prices are the preferred habit of retail investors. They also find that the characteristics of the retail clienteles of firms highly traded by retail investors are remarkably similar to those of investors who exhibit a greater propensity to speculate and gamble, as

documented in Kumar (2009). Our evidence thus further favors this conclusion as it applies to our bankrupt stocks.

5. Stock price performance after the announcement of Chapter 11 bankruptcy

In this section we examine the impact of gambling-motivated retail trading on stock prices. Kumar (2009) shows that investors who invest disproportionately more in lottery-type stocks experience greater underperformance. Moreover, Han and Kumar (2009) report that stocks with high levels of retail trading earn low average returns. Drawing on these two papers, we predict that the market will underreact to the announcement of bankruptcy; i.e., stock prices will continue to fall post-Chapter 11 filing, but rather slowly compared to what we would expect in a fully efficient market.[20] Our prediction is also consistent with theoretical theoretical papers that link retail trading and stock price performance. In particular, Scheinkman and Xiong (2003) demonstrate that stocks are overpriced when the level of retail trading is high, and Barberis and Huang (2008) show that stocks with high skewness should earn low average returns when retail investors display a preference for assets with skewed returns.

5.1. Initial evidence

To explore the stock price performance of bankrupt firms we follow Barber and Lyon (1997), and compute buy-and-hold abnormal returns (BHAR), which is also consistent with recent studies focusing on highly financially distressed firms (Dichev and Piotroski, 2001; Taffler, et al., 2004; Kausar et al., 2009). Buy-and-hold abnormal returns are computed as follows:

$$BHAR_i\left(\tau_1,\tau_2\right)=\prod_{t=\tau_1}^{\tau_2}\left(1+r_{i,t}\right)-\prod_{t=\tau_1}^{\tau_2}\left[1+E\left(r_{i,t}\right)\right] \tag{4}$$

where $BHAR_i\left(\tau_1,\tau_2\right)$ is the buy-and-hold abnormal return for firm i from time τ_1 to τ_2, $r_{i,t}$ is the raw return for firm i at time t and $E\left(r_{i,t}\right)$ is the expected return for firm i at time

[20] Kenneth French similarly speculates, in his blog with Eugene Fama, that the stocks of bankrupt firms will underperform. "In other words, I suspect that, on average, in-bankruptcy stock prices exceed the present value of their expected payoff." See http://www.dimensional.com/famafrench/2010/02/qa-bankrupt-firms-whos-buying-1.html.

t. Individual BHARs are averaged cross-sectionally as follows (e.g., Barber and Lyon, 1997):

$$\overline{BHAR(\tau_1,\tau_2)} = \frac{1}{n}\sum_{i=1}^{n} BHAR_i(\tau_1,\tau_2) \tag{5}$$

where $BHAR_i(\tau_1,\tau_2)$ is defined as in (4), and n is the number of firms. As suggested by Eq. (5), we use equally weighted rather than value-weighted returns since this is more appropriate in the context under analysis (e.g., Gilson, 1995). Additionally, previous research shows that equal weighting captures the extent of underperformance better than value weighting does (Brav, Geczy and Gompers, 2000), an important point given the particular nature of our bankrupt firms.

Unless otherwise stated, daily returns collected from CRSP are employed in the calculation of abnormal returns. We restrict our analysis to a one year post-filing period for two reasons.[21] First, filing for bankruptcy often leads to firm delisting, and thus extending the period for computing abnormal returns is problematic due to the loss of many sample cases (Morse and Shaw, 1988). Second, our typical sample firm spends an average (median) of 24.4 (18.1) months in bankruptcy, consistent with Eberhart et al. (1999) and Denis and Rodgers (2007). Similar to Michaely et al. (1995) we define a year as twelve 21-trading day intervals. Event day $t=+1$ is included in the bankruptcy announcement window together with days $t=-1$, and $t=0$, the bankruptcy announcement date, as firms are able to file their bankruptcy petition after the market closes (Dawkins et al., 2007).

Many of our sample firms are delisted in the 12-month period subsequent to their Chapter 11 filing date. Drawing on Shumway (1997), and Shumway and Warther (1999), we include the delisting return in the calculation of abnormal returns, a procedure also used by Campbell et al. (2008). As with Kausar et al. (2009) we assume that, in the post-delisting period, sample firms earn a zero abnormal return.[22]

[21] In un-tabulated results we re-run our analysis using monthly returns collected from CRSP. Results are consistent with those reported below.

[22] Reinvesting the proceeds from the delisting payment in a portfolio of stocks comprising the same size decile as the delisted firm, or in the CRSP value-weighted index, for the remainder of the compounding period, however, does not alter our results in any meaningful way.

Following Barber and Lyon (1997), we use a single control firm approach in our main results. Sample firms are matched on size and book-to-market, which is consistent with a number of studies exploring the medium-term market reaction of highly financially distressed firms to specific events (Dichev and Piotroski, 2001; Taffler et al., 2004; Kausar et al., 2009).[23] For illustrative purposes, and to allow comparisons with prior research on the market's reaction to bankruptcy announcements, we also report parallel market-adjusted return results using the equally weighted CRSP index including dividends as an alternative proxy for expected returns.

We employ a conventional t-test to infer the statistical significance of the mean BHARs (Barber and Lyon, 1997) using the cross-section of the buy-and-hold abnormal returns to form an estimator of their variance. Drawing on Kraft, Leone and Wasley (2006), we report mean BHARs that are winsorized at the 1% and 99% levels to reduce the impact of extreme outliers in our analysis.[24] We also present median returns to check the validity of our parametric results. A Wilcoxon signed rank-test is used to infer the statistical significance of such abnormal returns (Dawkins et al., 2007).[25]

Table 7 summarizes our results. Not surprisingly, we find that the market anticipates the formal announcement of bankruptcy, a phenomenon already documented in the literature (e.g., Clark and Weinstein, 1983; Datta and Iskandar-Datta, 1995; Dawkins et al., 2007). In fact, panel A of Table 7 shows that the mean (median) one-year pre-event abnormal return is -49% (-43%). All values are statistically significant ($p<0.01$). In addition, panel B of Table 7 shows a strong, negative reaction to the bankruptcy event, a result also in line with previous research on this topic (e.g., Datta and Iskandar-Datta, 1995; Dawkins et al., 2007). Regardless of benchmark, mean (median) abnormal return measured for the (-1,1) window is around -26% (-27%), and highly significant ($p<0.01$).

Table 7 here

[23] If a control firm is delisted before the ending date for its corresponding bankrupt firm period, a second firm is spliced in after its delisting date, that with second closest size and book-to-market to that of the delisted firm in the original ranking. Finally, if a chosen control firm itself subsequently files for bankruptcy, we treat it as if it is delisted on its bankruptcy date (Spiess and Affleck-Graves, 1995).

[24] For robustness, we also conduct unwinsorized tests and compute bootstrapped t-tests as suggested by Lyon, Barber and Tsai (1999). Results are essentially identical.

[25] We obtain the same results when we employ the nonparametric sign test.

The key results of panel C on Table 7, however, point to a strongly negative and statistically significant post-bankruptcy drift. Of special interest in this context is the (+2, +84) compounding window, which represents roughly a four-month post-event period. The Bankruptcy Reform Act of 1978 granted the incumbent management of firms filing for Chapter 11 an exclusivity period of 120 days to develop a reorganization plan. Accordingly, this is the period where information asymmetry between bankrupt firms' management and the market is most acute. Panel C of Table 7 shows that for this particularly important period mean (median) BHAR is -13% ($p<0.01$) (-15%; $p<0.01$).

The 6-month post-event period represented by the (+2, +126) compounding window provides further evidence in favor of the incomplete market reaction to bankruptcy announcement argument, with mean (median) BHAR = -16% ($p<0.01$) (-16%, $p<0.01$). Importantly, our conclusions do not change even if we consider a one-year post-event period. In effect, mean (median) BHAR for the (+2, +252) period = -28% (-27%), both significant at $p<0.01$. Interestingly, this post-event drift is of effectively identical magnitude to the loss in firm-value associated with the Chapter 11 filing itself, as highlighted in panel B.

Three ideas summarize our results. First, the market is able to anticipate the announcement of bankruptcy. This pattern has already been documented in previous work and is usually explained by information relating to the forthcoming bankruptcy being released to the market before the event date. Second, despite the market's anticipation of bankruptcy, the event in itself is still very important from an information perspective, with the short-term reaction to its announcement negative and very significant. This is, of course, not surprising, especially if one considers that filing for bankruptcy is surely the worst-case scenario in the corporate domain.

Our most interesting and original finding comes from the analysis of the stock return pattern *after* the bankruptcy event. Our results clearly suggest that the market *does not* fully and quickly incorporate the impact of the Chapter 11 announcement into the affected firms' stock price. In particular, we find a strong, negative, and statistically significant post-event drift that lasts for at least one full year after the Chapter 11 filing date with mean (median) BHAR of -28% (-27%). Our findings seem to be inconsistent with market efficiency, and appear to support the argument that markets are unable to digest bad news events on an unbiased and timely basis in all cases (e.g., Bernard and Thomas, 1989, 1990; Michaely et al., 1995; Dichev and Piotroski, 2001; Taffler et al., 2004; Kausar et al., 2009).

5.2. Robustness tests

Nonetheless, caution is needed when interpreting the results in the previous subsection; there is still much debate surrounding the appropriate measurement of longer-term abnormal returns (e.g., Lyon et al. 1999). Arguably, this is less of an issue over a one year post-event period compared with longer-term event studies (Kothari and Warner, 2007). Nonetheless, the special nature of our bankrupt stocks suggests we need to interpret their realized returns with some caution. To explore the reliability of our results we start by conducting a range of alternative event studies that test for a number of competing explanations for our anomalous results. In particular, we control for potential post-earnings announcement drift (Bernard and Thomas, 1989; 1990), post-going-concern modification drift (Kausar et al., 2009), the momentum effect (Jegadeesh and Titman, 1993), distress risk (as measured by Altman's z-score), and industry effects (e.g., Lang and Stulz, 1992). To save space we do not provide our results here.[26] However, they are all very similar to those reported in Table 7.[27] On this basis our main results are robust to a range of alternative explanations.

Fama (1998) and Mitchell and Stafford (2000) highlight some potential pitfalls when computing BHARs, and favor the calendar-time portfolio approach introduced by Jaffe (1974) and Mandelker (1974). As an additional robustness test, we also employ this alternative method here. Sample firms are added to a portfolio at the end of the month following their Chapter 11 filing date, and are held there for 6 or 12 months. The portfolio is rebalanced monthly removing all firms that reach the end of their 6- or 12-month holding period, and adding all firms filing for bankruptcy in the previous calendar month. Importantly, given the high degree of skewness affecting the distribution of bankrupt firm market capitalization, we employ equally weighted portfolio rebalancing strategies (Ikenberry and Ramnath, 2002).

Calendar-portfolio abnormal performance is assessed using Carhart's (1997) four-factor model.[28] The heteroskedastic-consistent t-statistic proposed by White (1980) is used to test the null hypothesis of no abnormal performance, and we employ both ordinary least squares (OLS) and weighted least squares (WLS) to estimate our equation parameters. Drawing on

[26] Detailed results are available from the first author.
[27] Mean (median) 6-month returns range from -15.0% (-16.0%) to -16.0% (-18.0%). Mean (median) 12-month returns range from -25.0% (-32.0%) to -34.0% (-35.0%).
[28] Neither using the Fama and French (1993) three-factor model, nor employing Ikenberry and Ramnath (2002) adjusted intercepts, alters our results.

Mitchell and Stafford (2000), and Ikenberry and Ramnath (2002) we drop from analysis all months where the calendar portfolio has fewer than 10 firms.

Table 8 summarizes our results. Irrespective of the estimation procedure and holding period, all intercepts are negative and statistically significant at conventional levels. This is consistent with our previous findings reported in Table 7, and indicates that a post-bankruptcy announcement drift equally occurs on a calendar-time basis. For the one-year horizon, abnormal performance estimated using OLS (WLS) is -2.7% (-2.6%) per month. The equivalent annualized figure of -32% (-31%) is very similar to the mean BHAR estimate of -28% in Table 7, panel C.[29]

Table 8 here

In summary, the results we obtain with the calendar-time method are consistent with those obtained when using BHARs controlling for a wide range of different risk factors. Both methods for measuring abnormal returns highlight at least a 12-month post-Chapter 11 drift that is highly negative and statistically significant in a market which we have shown is richly populated by retail investors apparently motivated by reasons of gambling.

Our results are qualitatively consistent with, although much stronger than, those reported by Kumar (2009), and Han and Kumar (2009). The former study shows that investors who allocate at least one-third of their portfolios to lottery-type stocks underperform by over 2.5% per annum, while the latter authors demonstrate that stocks highly traded by retail investors have an associated risk-adjusted premium of -5% per annum. In our case, bankrupt firms underperform by no less than 28% in the one year following the Chapter 11 filing date. This is consistent with the mispricing of bankrupt firms' stock being more extreme than in the case of pure lottery-stocks alone, or stocks mainly traded by retail investors.

6. Limits to arbitrage

Our results so far demonstrate that retail investors buy bankrupt stocks that subsequently lose them money. However, this does *not* explain why the market underreacts to the announcement of a Chapter 11 filing. In theory, it only takes one arbitrageur to ensure that

[29] Ikenberry and Ramnath (2002) point out that as the BHAR and calendar-time portfolio approaches differ in several respects, results are unlikely to be identical, quite apart from any potential misspecification problems.

the market, on average, reflects fundamental value (Shleifer, 2000, p. 4). As a potential explanation for the absence of arbitrage activity in this market, we explore the role of arbitrage implementation costs. As Barberis and Thaler (2005, p. 6) explain, these costs matter because they hinder arbitrageurs' ability to exploit a market mispricing. Additionally, in extreme cases, when it is too costly to learn about the mispricing, or the resources required to exploit it are too expensive, arbitrageurs may simply choose not to act (Merton, 1987).[30]

For measuring implementation costs we adopt a similar approach to that of Taffler et al. (2004), and Kausar et al. (2009). In our base scenario, the arbitrageur goes short in bankrupt firms and uses the net proceeds to buy shares of firms matched on size and book-to-market. For each pair of bankrupt and control firms, these initial trades occur two trading days after the Chapter 11 date. These positions are closed after a holding period of 252 trading days (i.e., roughly one year). When a given bankrupt firm is delisted during the holding period, the position on both bankrupt and control firm is prematurely closed at the delisting date. Variations to the base scenario include using control firms matched on alternative bases (size and momentum, industry and stock-price, size and z-score, and industry, size and book-to-market), opening the initial position at different post-event days, considering alternative holding periods, and inferring stock price behavior after the delisting date, as suggested by Taffler et al. (2004), and Kausar et al. (2009).[31]

A crucial issue is how transactions costs are handled. We consider three types of transactions costs: 1) stock borrowing costs, 2) trading commissions, and 3) the bid-ask spread.[32] The first affects the arbitrage strategy's profitability because the arbitrageur needs to borrow the bankrupt firms' stock before conducting the required short sale. Drawing on Kausar et al. (2009), and following D'Avolio (2002), we assume a shorting cost of 4.3% per

[30] Kenneth French, in his blog discussion with Eugene Fama, also points out that the amount of capital that the arbitrageur may need to post to be able to short bankrupt stocks could well be prohibitive in practice. In addition, she is exposed to substantial buy-in risk, the risk that the lender may call the shares, which may be very difficult or expensive to replace. See http://www.dimensional.com/famafrench/2010/02/qa-bankrupt-firms-whos-buying-1.html.

[31] Results are very similar to those reported below and are available from the first author.

[32] We ignore other trading cost components such as price impact, immediacy costs, and short-selling costs which will further add to the costs of implementing the arbitrage (Lesmond et al., 2004). For example, in the case of short-sale constraints, D'Avolio et al. (2002) document that 16% of stocks contained in CRSP files are potentially impossible to short (i.e., with, in effect, infinite shorting costs), largely firms in the bottom NYSE decile, and/or with a stock price under $5, a typical characteristic of bankrupt stocks.

annum for bankrupt companies below the sample's median market capitalization, and 1% per annum for all other firms.[33]

Commission costs are also very important because they have to be paid per transaction (both for bankrupt and control firms), thus reducing the financial benefit of engaging in any given trade. We follow Lesmond et al. (2004), and use a 4% commission rate for stocks under $1 per share, and 0.25% for all remaining stocks.

The bid-ask spread also plays a key role in assessing the transactions costs faced by investors, especially when dealing with small, less liquid stocks (Lesmond et al., 2004). This variable's impact is incorporated into the analysis by allowing all trades to be conducted at the respective bid or ask closing price (for both sample and control firms). Whenever one of these prices is not available, we follow Kausar et al. (2009) and estimate its value. In particular, the missing figure is inferred using the closing price for the relevant trading day, and half of the median bid-ask spread across all cases in the sample with available data. We estimate the bid-ask spread of both sample and control firms in three different ways. Specifically, we use both the quoted spread method of Stoll and Whaley (1983), and Bhardwaj and Brooks (1992), and also the direct effective spread of Lesmond et al. (2004). We also employ the limited dependent variable threshold (LDV) model proposed by Lesmond et al. (1999) to estimate the all-in (explicit and implicit) roundtrip costs of trading in both our sample and control firms.

Table 9 summarizes our results. These are very similar across all three bid-ask estimation methods we use. Our main finding is that, on average, a sophisticated investor engaging in an arbitrage strategy involving bankrupt firm stock may expect to lose a significant percentage of her investment. In the best case scenario, we find a loss of -11.2% for a 12-month holding period and -18.0% for a 6-month holding period. Median statistics also largely confirm that such arbitrageurs will not be able to make a profit since the majority of such returns are both negative *and* significant, and those positive do not differ significantly from zero at normal levels. Table 9 also provides evidence that arbitraging bankrupt stocks is very risky, with very high return standard deviations and inter-quartile ranges.

[33] Since the estimates of D'Avolio (2002) largely pertain to normal (i.e., not financially distressed firms) stocks, the figure of 4.3% per annum is likely to significantly underestimate the actual cost of shorting the stocks of bankrupt firms.

Table 9 here

Overall, it appears that only an "illusory profit opportunity" (Lesmond et al., 2004) exists in the market for bankrupt firm stock. This helps explain why the gambling-motivated behavior of retail investors, who predominate in this market, leads to the price of bankrupt firm stock being at variance with firm fundamental value even in the medium-term, without traditional market forces being able to correct this situation.

7. Discussion

This study starts by asking a simple question: who trades the stock of bankrupt firms and why? Our results show that retail investors have a strong predisposition to trade such securities, and that such propensity increases following the formal bankruptcy filing. We also find that, post-event, such investors end up holding 90% of these firms' stocks on average. Whereas regulatory restrictions may inhibit many institutional investors from holding and trading the stock of bankrupt firms (Del Guercio, 1996), however, some funds specialize in this market. This is the case, for example, of vulture funds (Rosenberg, 2000), and some hedge funds that invest only in distressed firms (Lhabitant, 2006, pp. 230-231).

Nonetheless, it is interesting that retail investors should be the main traders and stockholders of firms undergoing Chapter 11 reorganization. We show that bankrupt firms' stock possesses the fundamental characteristics of what Kumar (2009) defines as a lottery stock. In other words, for a small initial investment, this particular type of security offers a low probability of a high future reward, and a high probability of a small loss. Importantly, the very low market price that characterizes bankrupt firms' stock makes it possible for investors to earn large returns in the short-term when prices appreciate only a few cents. As such, the desire to gamble on the market may at least partially explain why so many retail investors actively trade the stocks of firms that are in bankruptcy. This key result is consistent with contemporaneous literature showing that certain types of retail investors are drawn toward stocks with speculative features such as high skewness, high volatility and low prices (Han and Kumar, 2009). It is also broadly consistent with the results of Dorn and Huberman (2010) who show that risk-seeking (or less risk-averse) retail investors hold and actively trade high volatility stocks, and with the work of Grinblatt and Keloharju (2009), and Dorn and

Sengmueller (2009), who establish that sensation-seeking investors as well as investors who trade for entertainment exhibit a preference for speculative stocks.

In the second part of the paper we investigate what happens to stock prices subsequent to the announcement of bankruptcy. Our evidence shows investors buying-and-holding these securities earn, on average, a highly significant negative return of -28% over the year after the bankruptcy filing date. (This is over and above the average adverse market reaction of -26% on the announcement of a Chapter 11 filing.) We run a number of robustness tests and find that our main result is not due to alternative explanations already documented in the literature (e.g., the post-earnings drift, the post-going concern modification drift, and the momentum effect). It is also robust to different event-study methods. Such findings are inconsistent with standard risk-return equilibrium models (for example, the 4-factor model in Carhart, 1997). On the other hand, our study is consistent with the results of Kumar (2009), who shows that investors who invest disproportionally more in lottery-like stocks experience greater underperformance, and with the work of Han and Kumar (2009) who report that stocks with high levels of retail trading significantly underperform low retail-trading-level stocks. Han and Kumar also document that such underperformance is stronger among stocks that have speculative features, i.e., high idiosyncratic volatility and skewness, and low price.

Our empirical results are also consistent with theoretical models that incorporate investor preference for skewness. Mitton and Vorkink (2007) introduce a model that departs from the standard expected utility theory of von Neuman and Morgenstern (1944) by allowing investors to have *heterogeneous* preferences for skewness. They demonstrate that investors with greater preference for skewness will, in equilibrium, select securities (and portfolios) with greater levels of skewness, especially those with higher levels of idiosyncratic skewness. In contrast to Mitton and Vorkink (2007), Barberis and Huang (2008) hypothesize an economy populated with cumulative prospect investors (Tversky and Kahneman,1992) that trade in both normally distributed return securities, and securities with positively skewed return distributions.[34] They demonstrate that in such an economy there are non-unique global optima, so that even though investors have *homogeneous* preferences they can hold different portfolios. On this basis, investors who overweight tails will take large, undiversified

[34] As the authors explain, a positively skewed security is simply one that earns an excess return *infinitesimally* above the risk-free rate. Barberis and Huang (2008) also show that the skewness of a security's excess returns is primarily determined by the probability of a large payoff: the higher such probability, the more skewed is the excess return of the security.

positions in skewed securities; this leads to a portfolio which behaves more like a lottery. Others, who do not overweigh tails as much, will hold a more diversified portfolio which is more consistent with mean-variance efficiency.

Kumar's (2009) lottery-like stocks argument fits well with both the theoretical models of Mitton and Vorkink (2007), and Barberis and Huang (2008) since the main characteristic of the security that generates the non-standard equilibria in both these models is idiosyncratic skewness. In the context of the Mitton and Vorking (2007) model, underdiversified investors (i.e., those who exhibit a more extreme preference for skewness) receive a constant reward in skewness that partially compensates for the lack of mean return (for a given level of variance) in their portfolios. As such, the abnormal negative performance we document for bankrupt firms' stock should be mitigated (or even disappear) if we account correctly for the compensation these investors obtain from investing in this skewed return asset. In contrast to Mitton and Vorking (2007), Barberis and Huang (2008) argue that investors who overweight tails are willing to pay a premium for the skewed security since this allows them to maximize their utility. As a result, they will earn a lower return on this security than they might expect in a standard mean-variance context. So, in the setting proposed by Barberis and Huang (2008), buying bankrupt firms' stock allows investors with skewed preferences to maximize their utility, at the cost of the final portfolio they hold not being mean-variance efficient. Nonetheless, irrespective of the particular theoretical model that may be consistent with the evidence of negative returns of bankrupt stocks we document, the preference for skewness as reflected in the desire to gamble may be the primary explanation why so many so many investors actively trade the stock of bankrupt firms. The myriad of anecdotal evidence available on this issue is also very consistent with our conjecture.

According to finance theory, a market pricing anomaly cannot sustain because arbitrageurs will undertake trades to eliminate it. In fact, in theory it takes only one arbitrageur to eliminate deviations from rational pricing (Shleifer, 2000: 4). Accordingly, in the last part of the paper we explore the potential role of such arbitrageurs in the market for bankrupt stocks. We find that in the context of bankrupt firms arbitrage activity is likely to be extremely costly. We show that an arbitrage strategy developed to exploit the market mispricing of such firms' stocks is not only very risky, but generates, on average, highly negative returns. Our analysis is conservative in that it fails to account for all possible sources of risk/implementation costs that a sophisticated investor needs to deal with when engaging in

arbitrage transactions involving the stock of bankrupt firms. Difficulty in shorting these stocks is a relevant illustration of this issue. For example, D'Avolio (2002) finds that a third of stocks with prices below $5 present in the CRSP database are hard to short. In fact, given their legal status, it is very likely that bankrupt firms are almost impossible to short. In addition, our results do not explicitly consider the full impact of other costs, such as holding costs, and idiosyncratic risk, which previous research has shown to play an important role in the profitability of arbitrage strategies and, are highly relevant in the context of bankrupt stocks (Pontiff, 2006). However, in practice, these limitations only strengthen the robustness of our findings.

Our results may also help explain the well-known inverse relation between stock returns and distress risk. Campbell et al. (2008) document that firms with a high risk of failure earn abnormally lower returns, benchmarked against the expected return derived from the standard asset pricing models, such as the Fama-French-Carhart model. See Fama and French (1993) and Carhart (1997). Our evidence on the behavior of bankrupt firm stocks offers an explanation. We find that arbitrageurs face high risks, and low average returns when arbitraging such highly financially distressed firms, and are thus likely not to engage in such strategies. Therefore, the "distress anomaly" discussed in Campbell et al. (2008) may be the result of nonstandard preferences of retail investors (with a high preference for skewness) *and* limits to arbitrage, much like what we find with firms in Chapter 11 reorganization.

8. Conclusion

This paper examines two main questions: 1) who trades the stock of bankrupt firms, and why?, and 2) what impact does such trading have on the market price of failed firms? It also directly addresses the issues raised recently in Eugene Fama and Kenneth French's blog entry "Bankrupt firms: Who's Buying?". We find that such securities are heavily traded by retail investors, who are also the main stockholders of these firms. We also show that bankrupt firms display striking lottery-like features, i.e., high idiosyncratic skewness and low price. As such, for a small price, these stocks offer the opportunity to realize a large profit with low probability, and a small loss with high probability. Hence, our results suggest that particular retail investors may be trading the stocks of bankrupt firms *as if* they were playing lotteries, and thus using such securities to "gamble on the market". When examining the pricing implications of this gambling-motivated retail trading we find that, after a negative return of

over 25% associated with the Chapter 11 announcement, post-event, investors in these bankrupt stocks will, on average, face further highly negative returns of -28% over the following 12 months. We also document that there are significant costs to arbitrage in this market. As such, the nonstandard preferences of retail investors (with a high preference for skewness), who represent the marginal traders in the stock of bankrupt firms, and thus set market prices, combined with limits to arbitrage explains the puzzling return evidence we document.

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Table 1

Defining the sample

This table summarizes the steps undertaken to define the sample. We start by identifying the set of firms that filed for bankruptcy between 10/01/1979 and 10/17/2005 from seven data sources. The firms considered in the final sample: 1) have enough data on CRSP and COMPUSTAT to conduct the analysis, 2) are domestic firms, trading common stock on a major exchange after filing for Chapter 11 bankruptcy. Financial or utility firms are excluded from the final sample.

	N
Initial nonoverlapping bankruptcy cases	3.437
Cases not found or with insufficient data on CRSP	1.411
Cases delisted before or at the bankruptcy filing month	1.556
Cases with insufficient data on COMPUSTAT	58
Firms classified as foreign	11
Utilities and financial firms	40
Firms filing Chapter 7	10
Final sample size	351

Table 2

Summary statistics

This table presents summary statistics relating to our sample of bankrupt firms and a control sample matched on size and book-to-market. For each sample firm, we identify all CRSP firms with a market capitalization between 70% and 130% of its equity market value. The respective control firm is then selected as that firm with book-to-market closest to that of the sample firm. Panel A reports fundamental accounting information. Panel B summarizes market related variables. Panel C presents other relevant firm characteristics. The p-value column on panels A and B shows the significance of a two-tailed t-test (Wilcoxon-Mann-Whitney test) for difference in means (medians).

Panel A: Accounting variables

	Sample firms (A)		Size and B/M (B)		Difference (A-B)			
Variable	Mean	Median	Mean	Median	Mean	P-value	Median	P-value
SALES ($m)	596.4	116.9	634.9	129.5	-38.5	0.7786	-12.6	0.3301
TA ($m)	646.6	89.7	754.6	128.1	-108.0	0.5532	-38.4	0.2360
ROA	-19%	-6%	-15%	1%	-4%	0.2592	-7%	<0.0001
Z-Score	1.37	1.31	2.14	2.12	-0.77	0.0040	-0.81	0.0049
CUR	169%	128%	231%	178%	-62%	0.0008	-50%	<0.0001
LEV	45%	40%	36%	33%	9%	0.0006	7%	0.0005

SALES: sales in $m. TA: total assets in $m. ROA: return on assets (net income/total assets). Z-Score: bankruptcy-risk proxy (Altman, 1968). CUR: current ratio (current assets/current liabilities). LEV: leverage proxy (total debt/total assets). All data is collected from the last annual accounts reported before the bankruptcy year.

Table 2 (cont.): Summary statistics

Panel B: Market related variables

	Sample firms (A)		Size and B/M (B)		Difference (A-B)			
Variable	Mean	Median	Mean	Median	Mean	P-value	Median	P-value
Size ($m)	160.0	32.3	159.6	32.2	0.5	0.990	0.04	0.738
Book/Market	4.2	2.3	3.8	2.2	0.4	0.432	0.1	0.543
Pre_Price ($)	4.97	3.12	9.80	5.49	-4.83	<0.001	-2.37	<0.001
Event_Price($)	2.08	0.97	8.67	4.38	-6.59	<0.001	-3.41	<0.001
Post_Price ($)	2.98	0.71	8.84	4.27	-5.86	<0.001	-3.56	<0.001
Pre_Volume	0.51%	0.34%	0.44%	0.25%	0.07%	0.056	0.09%	0.003
Event_Volume	1.15%	0.61%	0.42%	0.23%	0.73%	<0.001	0.38%	<0.001
Post_Volume	0.57%	0.30%	0.43%	0.24%	0.14%	0.189	0.06%	0.028
Pre_Tdays	250	252	227	249	23	<0.001	3	<0.001
Post_Tdays	230	246	224	248	6	0.095	-2	0.006
Pre_Qs	8.27%	6.85%	6.25%	4.30%	2.02%	<0.001	2.55%	<0.001
Post_Qs	12.50%	10.70%	7.18%	4.38%	5.32%	<0.001	6.32%	<0.001
Pre_Direct	5.83%	5.16%	3.79%	2.96%	2.04%	<0.001	2.20%	<0.001
Post_Direct	8.94%	6.61%	3.94%	2.64%	5.00%	<0.001	3.97%	<0.001
Pre_LDV	11.22%	9.03%	8.89%	6.85%	2.33%	<0.001	2.18%	<0.001
Post_LDV	14.48%	12.30%	10.44%	8.34%	4.04%	<0.001	3.96%	<0.001

Size: market capitalization in $m. Book/Market: book-to-market ratio. Pre_Price: daily average stock price for the 12-month period preceding the bankruptcy filing month (in dollars). Event_Price: same as Pre_Price, but for the 30-calendar day period centered on the bankruptcy announcement date. Post_Price: same as Pre_Price, but for the 12-month period after the bankruptcy announcement month. Pre_Volume: average daily trading volume (volume/shares outstanding) computed for the 12-month period preceding the bankruptcy announcement month. Event Volume: same as Pre_Volume but for the 30-calendar day period centered on the bankruptcy announcement date. Post_Volume: same as Pre_Volume but for the 12-month period after the bankruptcy announcement month. Pre_Tdays: number of days on which trading takes place in the calendar year preceding the bankruptcy announcement month. Post_Tdays: same as Pre Tdays but for the calendar year following the bankruptcy announcement month. Pre_Qs: quoted bid-ask spread for the pre-event period, computed as in Stoll and Whaley (1983). Post_Qs: same as Pre_Qs, but for the post-event period. Pre_Direct: direct effective bid-ask spread estimate for the pre-event period, computed as in Lesmond, Schill and Zhou (2004). Post_Direct: same as Pre_Direct, but for the post-event period. Pre_LDV: all-in (explicit and implicit) roundtrip cost for the pre-event period, computed as in Lesmond, Ogden and Trzcinka (1999). Post_LDV: same as Pre_LDV, but for the post-event period. All pre-event (post-event) bid-ask estimates are computed with daily data collected from CRSP using a period that begins one year before (one week after) the bankruptcy date of the event firm and ends two weeks before that date (one year after that date or at the delisting date of the event firm, whichever comes first). The same bankruptcy date is used for each pair of event and nonevent firms.

Table 2 (cont.): Summary statistics

Panel C: Other Characteristics

	Sample firms		Size and B/M	
Variable	Positive cases	% of sample	Positive cases	% of sample
EPS	88	25.1	172	49.0
Divid	91	25.9	134	38.2
GC	88	25.3	7	2.0
Delist	195	55.6	-	-

EPS: earnings per share dummy (1 if positive, 0 otherwise). Divid: dividend paid dummy (1 if dividend paid, 0 otherwise). GC: auditor opinion dummy (1 if going-concern modified audit report – defined as per Kausar et al. (2009), 0 otherwise). Delist: delist dummy (1 if company is delisted within one-calendar year of the bankruptcy date, 0 otherwise). All accounting variables are taken from the last annual accounts reported prior to the bankruptcy year.

Table 3

Institutional Stockholdings in Chapter 11 firms

This table presents institutional stockholdings for our sample of bankrupt firms and a control sample matched on size and book-to-market. For each sample firm, we identify all CRSP firms with a market capitalization between 70% and 130% of its equity market value. The respective control firm is then selected as that firm with book-to-market closest to that of the sample firm. Institutional ownership is computed as $Inst_{i,q} = Shares\ held_{i,q} \big/ Shares\ outstanding_{i,q}$, where $Shares\ held_{i,q}$ is the number of shares of firm i held by institutional investors at the end of event-quarter q and $Shares\ outstanding_{i,q}$ is firm i's outstanding shares at the end of event-quarter q. Event-quarter 1 is the first post-Chapter 11 quarter for which institutions have to report their stockholdings to the SEC. The last two columns report the two-tailed significance level from a t-test and a Wilcoxon-Mann-Whitney test for the difference in means and medians, respectively. N reports the number of firms with available information to compute $Inst_{i,q}$ in event-quarter q.

Event Quarter	$Inst_{i,q}$ for Sample firms			$Inst_{i,q}$ for Control firms			Significance	
	Mean	Median	N	Mean	Median	N	Mean	Median
-8	24.4%	20.1%	263	24.2%	19.4%	323	0.919	0.504
-7	24.1%	20.1%	274	23.9%	19.5%	324	0.935	0.628
-6	22.5%	17.6%	282	24.4%	20.0%	326	0.270	0.616
-5	21.9%	17.1%	288	24.1%	19.9%	330	0.173	0.470
-4	20.6%	15.5%	299	25.4%	20.4%	327	0.004	0.028
-3	19.6%	14.3%	303	24.1%	19.4%	330	0.004	0.027
-2	18.0%	12.7%	306	24.0%	19.7%	326	<0.001	0.001
-1	16.1%	10.7%	310	23.4%	19.5%	330	<0.001	<0.001
1	11.6%	7.9%	306	23.2%	17.9%	333	<0.001	<0.001
2	11.0%	6.7%	264	23.4%	17.5%	333	<0.001	<0.001
3	11.1%	6.1%	229	23.8%	17.5%	331	<0.001	<0.001
4	11.2%	5.9%	198	22.9%	16.5%	335	<0.001	<0.001

Table 4

Percentage of retail and sophisticated trades on the stock of bankrupt firms

This table presents retail and sophisticated investors relative percentage trading on the stock of our sample of bankrupt firms. The period is from 01/01/1993 to 12/31/2000. Trades less than (greater than) $5,000 ($50,000) are used to proxy for retail (sophisticated) investor trades. We measure retail investors' trading (SMALL) for each firm *i* in event month *t* as the ratio of the number of retail investors' trades over the total number of trades. We measure sophisticated trading (LARGE) in a similar manner but the numerator is now the number of trades by sophisticated investors. For each event month t, the SMALL/LARGE column displays the proportion of retail trades to sophisticated trades. Each event month is defined as a 21 trading-day period counted from the bankruptcy announcement date. Event month 1 is the first post-bankruptcy month. *N* reports the number of firms with available information to compute SMALL and LARGE each event-month.

Panel A: Pre-bankruptcy period

Event Month	SMALL	LARGE	SMALL / LARGE	N
-12	61.3%	6.5%	9.36	98
-11	66.3%	6.3%	10.57	102
-10	66.6%	6.0%	11.16	103
-9	60.7%	7.7%	7.85	103
-8	67.3%	6.4%	10.46	103
-7	71.5%	5.2%	13.75	100
-6	73.2%	4.3%	16.95	101
-5	73.7%	4.2%	17.62	102
-4	77.2%	3.4%	22.51	99
-3	81.3%	2.7%	30.65	104
-2	82.9%	2.5%	32.53	101
-1	85.5%	1.9%	44.10	107

Table 4 (cont.): Percentage of retail and sophisticated trades on the stock of bankrupt firms

Panel B: Post-bankruptcy period

Event Month	SMALL	LARGE	SMALL / LARGE	N
1	88.5%	1.5%	57.66	102
2	87.6%	1.4%	63.90	42
3	86.6%	1.9%	45.95	38
4	82.2%	2.4%	34.02	34
5	72.1%	3.5%	20.53	32
6	68.0%	2.9%	23.39	32
7	69.6%	4.2%	16.52	32
8	70.5%	3.2%	21.98	32
9	71.8%	3.2%	22.30	30
10	73.2%	3.9%	18.74	30
11	75.7%	2.7%	28.15	32
12	78.4%	2.9%	15.84	33

Table 5

Investor sentiment and trading in the stock of bankrupt firms

This table presents retail and sophisticated investors' buy-sell order imbalance for our sample of bankrupt firms. The period is from 01/01/1993 to 12/31/2000.Trades less than $5,000 are used as a proxy for retail investor trades, while trades greater than $50,000 are used as a proxy for sophisticated trades. Using Lee and Ready's (1991) algorithm, we then classify each trade as either being buyer or seller initiated. Each event-quarter is defined as a 63 trading-day period counted from the bankruptcy announcement date. In panels A and B, the row Diff. Buy-Sell provides the p-value of a test for difference in proportions of buys and sells per investor type in event-quarter q.

Panel A: Pre-Chapter 11 results

Event-Quarter	Order sign	Sophisticated	Retail
-4	Buy	46.9%	49.7%
	Sell	48.6%	46.3%
	Diff. Buy-Sell	<0.01	<0.01
-3	Buy	46.8%	48.3%
	Sell	49.0%	47.4%
	Diff. Buy-Sell	<0.01	<0.01
-2	Buy	45.7%	51.1%
	Sell	50.2%	45.1%
	Diff. Buy-Sell	<0.01	<0.01
-1	Buy	45.6%	50.4%
	Sell	48.8%	45.0%
	Diff. Buy-Sell	<0.01	<0.01

Table 5 (cont.): Investor sentiment and trading in the stock of bankrupt firms

Panel B: Post-Chapter 11 results

Event-Quarter	Order sign	Sophisticated	Retail
1	Buy	42.4%	52.9%
	Sell	49.9%	41.9%
	Diff. Buy-Sell	<0.01	<0.01
2	Buy	47.2%	49.7%
	Sell	50.1%	46.0%
	Diff. Buy-Sell	<0.01	<0.01
3	Buy	48.3%	48.1%
	Sell	48.1%	47.7%
	Diff. Buy-Sell	0.81	0.07
4	Buy	46.3%	46.9%
	Sell	48.4%	48.7%
	Diff. Buy-Sell	<0.01	0.06

Table 6

Bankrupt firms as lottery-stocks: basic characteristics

This table presents the lottery-stock type characteristics for our sample of bankrupt firms. The column "sample firms" reports the characteristics of our sample firms in two periods: the pre-event 12-month period (Pre) and the post-event 12-month period (Pos). The column "control firms" reports the same characteristics for a matched sample based on size and book-to-market for the same 12-month periods. For each sample company, we identify all CRSP firms with a market capitalization between 70% and 130% of its equity market value. The respective control firm is then selected as that firm with book-to-market closest to that of the sample firm. The Kumar (2009) column is adapted from table II of Kumar (2009). We follow Kumar (2009) in computing all values for our sample and control firms.

Stock Characteristics	Sample Firms		Control Firms		Kumar (2009)		
	Pre	Post	Pre	Post	Lottery	Non-Lottery	Other
Stock Price	$4.97	$2.98	$9.80	$8.84	$3.83	$31.7	$17.5
Total Skewness	0.17	1.06	0.53	0.69	0.33	0.18	0.24
Systematic Skewness	-1.6	-44.22	-4.84	-7.38	-0.20	-0.06	-0.11
Idiosyncratic Skewness	0.16	0.94	0.53	0.66	0.73	-0.04	0.33
Total Volatility	8.51	13.8	4.91	5.32	78.57	3.29	22.14
Idiosyncratic Volatility	8.24	12.47	4.73	5.12	75.56	2.96	20.36
Market Beta	0.94	1.39	1.02	1.11	1.09	0.91	0.90
Amihud Illiquidity	43.77	124.9	12.98	10.91	70.16	0.47	15.13
Firm Age	8.87	-	15.1	-	5.78	12.1	11.87
Percentage Without Analyst Coverage	50.1%	58.6%	47.3%	48.1%	71.3%	21.2%	36.9%
Mean Number of Analysts	5.2	4.11	6.4	6.48	3.93	12.4	6.49
Percentage of Institutional Ownership	16.1%	11.6%	23.4%	23.4%	7.35%	49.3%	30.1%

Table 6 (cont.): Bankrupt firms as lottery-stocks: basic characteristics

Total volatility: standard deviation of daily stock returns. Idiosyncratic volatility: standard deviation of the residual obtained by fitting a four-factor model. Total skewness: scaled measure of the third moment of daily stock returns. Systematic skewness: coefficient of the squared market factor in the skewness regression. Idiosyncratic skewness: scaled measure of the third moment of the residual obtained by fitting a two-factor model. Stock price: daily average stock price. Market beta: beta coefficient obtained by fitting a two-factor model. Amihud illiquidity: absolute daily returns per unit of trading volume. Firm age: number of years since the stock first appears in CRSP until its bankruptcy announcement year. Percentage without analyst coverage: proportion of firms without analyst coverage. Mean number of analysts: mean number of analysts per stock. Percentage institutional ownership: percentage of total shares outstanding owned by 13F institutions.

Table 7

Market reaction to Chapter 11 filing

This table presents the size and book-to-market risk-adjusted buy-and-hold abnormal returns for our sample firms. All compounding periods are in trading days, where day zero is the date of entering into Chapter 11 proceedings. Market adjusted returns (using the CRSP equally weighted index as benchmark) are reported in the two first columns. The two last columns report the results using a control firm approach where firms are matched according to size and book-to-market. For each sample company, we identify all CRSP firms with a market capitalization between 70% and 130% of its equity market value. The respective control firm is then selected as that firm with book-to-market closest to that of the sample firm. The two-tailed significance level derived from the t-statistic (Wilcoxon signed rank-test) is reported below the corresponding mean (median).

Panel A: Pre-event returns

	Market Adjusted Returns		Size and B/M Adjusted Returns	
	Mean	Median	Mean	Median
(-252,-2)	-0.89	-0.91	-0.49	-0.43
	<0.001	<0.001	<0.001	<0.001
(-126,-2)	-0.62	-0.64	-0.42	-0.42
	<0.001	<0.001	<0.001	<0.001

Panel B: Short-term market reaction

	Market Adjusted Returns		Size and B/M Adjusted Returns	
	Mean	Median	Mean	Median
(-1,+1)	-0.27	-0.28	-0.26	-0.27
	<0.001	<0.001	<0.001	<0.001
(-2,+2)	-0.28	-0.31	-0.27	-0.31
	<0.001	<0.001	<0.001	<0.001

Panel C: Post-event returns

	Market Adjusted Returns		Size and B/M Adjusted Returns	
	Mean	Median	Mean	Median
(+2,+84)	-0.14	-0.24	-0.13	-0.15
	<0.001	<0.001	0.014	<0.001
(+2,+126)	-0.20	-0.33	-0.16	-0.16
	<0.001	<0.001	0.005	0.001
(+2,+252)	-0.48	-0.67	-0.28	-0.27
	<0.001	<0.001	<0.001	<0.001

Table 8

Calendar-time portfolios

This table reports abnormal stock returns for calendar-time portfolios formed using our sample firms. Firms are added to the portfolio at the end of the month following the Chapter 11 announcement and are held for 6 or 12 months. Portfolio returns are computed assuming an equally weighted investment strategy. Months where the portfolio holds less than 10 stocks are deleted. The abnormal returns are determined using the 4-factor model in Carhart (1997). The parameters are estimated using both OLS and WLS. Monthly returns in the WLS model are weighted by the square root of the number of firms contained in the calendar-time portfolio in that month. The regression intercept provides an estimate of monthly abnormal performance. Heteroskedasticy robust t-statistics are reported in parenthesis. *N* indicates the number of observations (months) included in the estimation procedure.

	WLS		OLS	
	6 months	12 months	6 months	12 months
Intercept	-0.047	-0.026	-0.053	-0.027
	(-3.88***)	(-2.99**)	(-4.08***)	(-2.70*)
b	1.136	1.001	0.942	(0.972)
	(3.75***)	(4.56***)	(3.53***)	(4.75***)
s	3.505	2.991	2.449	2.013
	(8.34***)	(9.90***)	(3.84***)	(4.16***)
h	2.210	1.803	0.971	0.920
	(4.44***)	(4.92***)	(1.5)	(1.87)
u	-0.861	-0.623	-0.898	-0.7035
	(-2.61*)	(-2.62*)	(-1.95)	(-1.71)
N	108	204	108	204
Adj R^2	0.2631	0.3111	0.1672	0.2156

*, **, *** indicate significance at the 5%, 1%, and 0.1% levels respectively.

Table 9

Illustrative profits earned with an arbitrage strategy involving bankrupt firms' stock

This table presents the results obtained with an illustrative zero-investment strategy in event time using our sample firms. The arbitrageur goes short on each bankrupt firm and uses the net proceeds to buy shares of a matched firm sharing similar characteristics. For each sample company, we identify all CRSP firms with a market capitalization between 70% and 130% of its equity market value. The respective control firm is then selected as that firm with book-to-market closest to that of the sample firm. The initial trades occur two trading days after the event date and the positions are closed after a period of 252 (126) trading days or at the delisting date of the event firm, whichever comes first. Three types of transaction costs are considered in the computation of the results presented below: 1) stock borrowing costs; 2) trading commissions, and 3) the bid-ask spread. A shorting cost of 4.3% *per annum* is used for the bankrupt firms below the sample's median market capitalization, and a shorting cost of 1% *per annum* is used for all other firms. A 4% commission rate is used for both bankrupt and control firms with stock prices below $1 per share; a 0.25% commission rate is used in the remaining cases. The impact of the bid-ask spread is incorporated into the analysis by allowing all trades to be conducted at the respective bid or ask closing price (for both sample and control firms). Whenever one of these prices is not available, we estimate its value. The missing figure is inferred using the closing price for the relevant trading day and half of the median bid-ask spread across all cases in the sample with available data. Three different bid-ask estimates are considered: the direct effective spread column refers to the bid-ask spread computed as in Lesmond et al. (2004); the quoted spread column refers to the bid-ask spread computed as in Stoll and Whaley (1983); the LDV effective spread column refers to the bid-ask spread computed as in Lesmond et al. (1999). The two-tailed significance level derived from t-statistics (Wilcoxon signed rank-test) is reported below the corresponding mean (median).

	Direct spread		Quoted spread		LDV spread	
	6-months	12-months	6-months	12-months	6-months	12-months
Mean	-18.0%	-11.2%	-20.3%	-14.4%	-21.5%	-15.4%
p-value	0.001	0.065	<0.001	0.027	<0.001	0.018
Median	-5.1%	1.2%	-5.7%	1.0%	-6.1%	-2.1%
p-value	0.010	0.342	0.002	0.168	0.001	0.116
St.Dev.	89.0%	120.1%	90.2%	121.3%	79.8%	122.6%
25th percentil	-54.5%	-57.4%	-57.8%	-60.1%	-59.3%	-61.6%
75th percentil	37.5%	48.1%	35.6%	46.4%	35.0%	44.8%