# Informed options trading prior to bankruptcy filings

LI Ge
*University of Hong Kong*

Jianfeng HU
*Singapore Management University*, JIANFENGHU@smu.edu.sg

Mark Humphery-Jenner
*University of New South Wales*

Tse-Chun LIN
*University of Hong Kong*

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Li Ge[†]     Jianfeng Hu[‡]     Mark Humphery-Jenner[§]     Tse-Chun Lin[¶]

This version: December 18, 2014

## Abstract

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*JEL Classification*: G12, G14, G33

*Keywords*: Bankruptcy, O/S, Informed Options Trading, Insider Trading

[†]Faculty of Business and Economics, The University of Hong Kong. Tel.: +852 2859-1058; E-mail: geli1019@hku.hk.

[‡]Singapore Management University. E-mail: jianfenghu@smu.edu.sg.

[§]UNSW Business School, UNSW Australia. Tel.: +612 9385-5853; E-mail: mlhj@unsw.edu.au.

[¶]Faculty of Business and Economics, The University of Hong Kong. Tel.: +852 2857-8503; E-mail: tsechunlin@hku.hk.

# Informed Options Trading Prior to Bankruptcy Filings

**Abstract**

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# 1. Introduction

Bankruptcy filings are major corporate restructuring events that are on average associated with significantly negative announcement returns. The literature on pre-filing informed trade has focused on insider trade in the stock market and has produced mixed results. Part of the reason could be that prior studies have focused on insider trading in the equities market, whereas recent literature indicates that informed traders, a sub-set of which are insiders, often trade in the options market (Cao et al., 2005; Chan et al., Forthcoming), and that "options markets may be relatively more attractive venues for traders acting on 'bad' news" (Easley et al., 1998, p.458). This paper digs deeper into pre-filing informed trade. We examine whether the existing informed options trading measure, proxied by options trading volume divided by stock trading volume, can predict bankruptcy announcement returns. We also study the informativeness of insider trades in the options market.

Prior evidence on pre-bankruptcy informed trading is limited and the results are mixed. Seyhun and Bradley (1997) examine 525 firms that filed for bankruptcy between 1963 and 1992. They find that corporate insiders (i.e. top executives) sell stock prior to bankruptcy filings. However, Gosnell et al. (1992) find that while insider trading does increase over the five-months before the bankruptcy filing, pre-filing insider stock-trading over the two year period prior to the filing is not significantly different from that in an industry-size matched sample of non-filing firms. Beneish et al. (2012) and Chen et al. (2013) suggest that insiders prefer not to sell stock before negative news, at least partially to reduce the risk of a law suit. The mixed findings in relation to pre-bankruptcy insider trading could reflect the narrow focus on a single asset class: equities.

The existing literature suggests that the options market can be a preferred venue for informed trade. Easley et al. (1998) provide theoretical evidence that informed traders may choose the options market to capitalize on their private information, benefiting from the higher leverage and liquidity in the options market. Recent empirical studies find that options trading contains information on future stock returns (see e.g. Cremers and Weinbaum, 2010;

Johnson and So, 2012; Pan and Poteshman, 2006; Roll et al., 2010; Xing et al., 2010) and can be a location of price-discovery (Chakravarty et al., 2004). Other papers show that options trading contains information on several important upcoming corporate events, such as takeovers (Augustin et al., 2014; Cao et al., 2005; Chan et al., Forthcoming), earnings announcements (Jin et al., 2012; Roll et al., 2010), and analyst news (Lin et al., 2013). In addition, Poteshman (2006) investigates unusual put option buying before the terrorist attack on September 11, 2001, finding informed trading in the options market for two airline companies prior to the attack. Therefore, informed traders may trade in the options market before the extreme corporate event of a bankruptcy filing.

We hypothesize that both insiders and informed traders take advantage of the higher leverage of the options market to capitalize on their private information prior to bankruptcy filings. We expect that this will manifest in a relationship between pre-filing options trading and returns around the bankruptcy filing. However, a firm's financial distress usually develops over time, and there might be a significant leakage of information in the public space. If the information is leaked and incorporated into the stock market before the filing date, we would observe no announcement surprise in stock price, and most importantly, we wound find no correlation between pre-filing informed option trading and bankruptcy filing returns. In other words, if we find no correlation between pre-filing options trading and announcement returns, it does not mean that there is no informed trading. It could be that all the information has been fully reflected before the events. Indeed, such information leakage would make it *more* difficult to find our hypothesized result. However, if we do find the return predictability, there must be some informed trading and the information is not fully absorbed before the event.[1]

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[1]While it is possible that a non-trivial amount of pre-filing trade could be due to non-informed traders "mimicking" informed traders' activities, the presence of such "mimicking" trades actually pre-supposes the presence of informed trade. Thus, the presence of any "mimicking" trade would leave the qualitative interpretation of our results intact.

Empirically, we start by examining the extent to which pre-filing insider trade in the equity market and the options market can predict bankruptcy returns. We then adopt the relative trading volume of options to stock ratio (O/S) to proxy for informed options trading activity (as per Johnson and So, 2012; Roll et al., 2010), where a higher O/S value indicates higher options trading relative to stock trading and suggests a greater degree of informed options trading (Roll et al., 2010). Roll et al. (2010) show that informed trade drives the cross-sectional and time-series characteristics of O/S. Johnson and So (2012) show that O/S is negatively related to future stock returns. O/S is thus expected to be negatively correlated with stock returns around bankruptcy filing dates.[2] Compared with measures that are derived purely from options-market trading, O/S has the advantage of allowing us to examine the location of informed trade.

We construct a sample of bankruptcy-filings and examine the relationship between stock trading, options trading and filing-returns. The bankruptcy filings are from the UCLA-LoPucki Bankruptcy Research Database (BRD), has featured in the prior bankruptcy literature (e.g. Jiang et al., 2012).[3] We consider firms that file for bankruptcy while still listed (compared with those file for bankruptcy after delisting), and who were listed between 1996 and 2012. We ensure that the results are robust to expanding the sample to examine trading behavior around delistings where the firm subsequently files for bankruptcy (as opposed to the situation where the company files for bankruptcy while still listed). We analyze a sam-

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[2]While it is true that some non-informed traders can attempt to "mimic" informed traders, giving rise to the appearance of informed trade this does not adversely affect our results. First, there is no per se reason to believe that "mimicking" trades would systematically occur more in options or in stock. "Mimicking" trades could change the magnitude of the coefficient on O/S. If they occur equally, then the denominator and numerator of O/S increase by the same scalar, so "mimicking" effects have no impact on the relation between O/S and bankruptcy returns. Second, if they do systematically occur in either the options or stock market, then it simply multiples O/S by a scalar, and it presupposes the existence of informed trade (to "mimic"). So, our results are qualitatively unchanged.

[3]We thank Lynn M. LoPucki at UCLA for sharing this database.

ple of 131 bankruptcy-events for which we can obtain all relevant firm-level variables and in which there is some insider trade. We then exclude those firms without options trading in this period and obtain a sample of 58 unique bankruptcy filing cases.

We start by examining the location of informed insider trade prior to bankruptcy filings. We analyze the extent to which pre-filing insider trading in the options market and equities market predicts bankruptcy filing returns. We find that insider stock trading, over the period 2 days to 252 days before the filing date, is insignificantly related to bankruptcy returns. However, insider options trading over that period is negatively, and statistically significantly, related to bankruptcy returns. A one standard deviation increase in the amount of insider options trading is associated with a 13.27% reduction in bankruptcy announcement returns.[4] This implies that the options market is the preferred location of trade for insiders. However, it does not per se indicate the preferred location of trade for non-insiders.

We next analyze the location of informed trade prior to bankruptcy filings. Insiders typically cannot trade their own stock in the few days prior to a bankruptcy filing (as this would likely violate insider trading laws). However, if information is leaked to outsiders, they can enjoy a large profit in the options market by virtue of its embedded leverage. We find that the O/S measure from Roll et al. (2010), computed over the interval from two days to four days before the bankruptcy filing, is significantly and negatively related to bankruptcy-filing returns. A one standard deviation increase in O/S is associated with a 10.84 percentage point decrease in bankruptcy announcement returns.[5] We find similar results whether we use the pre-bankruptcy *level* of O/S or its *change* from the pre-bankruptcy benchmark period, i.e., 200 to 100 days before the bankruptcy filing, suggesting that the results are not merely an artefact of the sample firms having a generally higher baseline level of options trade than

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[4]We obtain this coefficient by multiplying the coefficient on insider options trading in Column 4 of Table 5 by the O/S standard deviation from Table 2.

[5]We obtain this coefficient by multiplying the coefficient on O/S in Column 4 of Table 5 by the O/S standard deviation from Table 2.

other firms.

Other stock-level characteristics can influence the role of O/S. Illiquidity in the options market (as proxied by the options bid-ask spread) reduces O/S's return predictability, consistent with Easley et al. (1998). Additionally, negative stock returns prior to bankruptcy reduce the predictive power of O/S, suggesting that if informed traders have capitalized on their private information about the bankruptcy by trading in the stock market, then the predictive power of O/S is lower.

We support these findings with simulation evidence, which helps to alleviate the concerns about identification, spurious correlation, and the small sample of bankrupt firms with options trading. We examine whether the negative predictability of O/S only exists around our bankruptcy filings, or also exists on other normal days for non-bankruptcy firms. We adopt three approaches: (1) we analyze the predictive power of O/S for the bankrupt firms in the non-bankrupt period, (2) we examine the predictive power for O/S for a randomly chosen non-filing firm on the filing date, (3) we assess the predictive power of O/S for a randomly chosen non-bankrupt firm on a randomly chosen non-filing date. In each case we run the simulation 1,000 times (i.e. we run 1,000 regressions, each with 58 observations, in order to match the sample size used in the baseline regressions). We find that the predictive power of O/S is significantly lower in these simulated pseudo-events, suggesting that informed trade in the options market significantly increases prior to bankruptcy events.[6]

Our paper contributes to the literature by addressing the question whether options trading prior to bankruptcy filing contains any information on this extreme event. These findings help to resolve some of the prior (conflicting) evidence on the presence of pre-bankruptcy informed trade, which tends to find limited evidence of pre-filing informed stock-trade. Whereas prior studies have focused on insider (i.e. top executive) trade in the equities market, we focus on options trading (not necessarily from corporate insiders). We also examine

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[6]The finding that O/S has negative return predictability for non-bankrupt firms on non-filing dates is consistent with Johnson and So (2012).

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the factors that can influence the presence of informed trade in the options market. The findings have important policy implications for regulators when monitoring trading activity around bankruptcy events.

The structure of this paper is as follows. Section 2 details the prior literature and presents the hypotheses. Section 3 details the sample construction. Section 4 presents the regression results. Section 5 concludes.

## 2. Prior Literature and Hypotheses

There is limited prior evidence on pre-bankruptcy informed trade, and the results tend to be mixed. Seyhun and Bradley (1997) find that insiders engage in significant sell-offs prior to bankruptcies. Iqbal and Shetty (2002) indicate that insiders sell shares prior to the anticipation of bankruptcy by investors. Ma (2001) suggests that insiders reduce equity purchases prior to Chapter 11 bankruptcies. However, Ma (2001) finds limited evidence that insiders engage in additional sales prior to bankruptcies. Further, Gosnell et al. (1992) suggest that pre-bankruptcy insider-trades are not significantly different from those of insiders at an industry-size matched control sample. Nasser and Gup (2008) find no evidence of insider trading in the equities market prior to 129 major bankruptcies between 1995 and 2006. Chen et al. (2013) argue that insiders might actively try to avoid selling in the equities market around negative news (in their case, "going concern" statements) due to the risk of law suits. Similarly, Beneish et al. (2012) find that insiders prefer not to sell stock prior to bad news (potentially engaging in earnings management to avoid the appearance of doing so). Overall, the prior literature, which has focused solely on the equities market, shows only limited evidence on the presence of pre-filing informed trade.

Examining options-based trade could help to provide further insight into the presence of pre-bankruptcy informed trade and resolve the conflicting literature. While the options market need not always contain additional information that has not already been reflected

in the stock market (Muravyev et al., 2013), prior literature suggests that the options market can be a location of informed trade, allowing informed traders to capitalize on their information while benefiting from the higher leverage and higher liquidity in the options market (see e.g. Beck, 1993; Easley et al., 1998). Subsequently, Truong (2012) argues that the presence of options trading increases the informativeness of stock prices. Hu (Forthcoming) suggests that options trades and quotes influence stock prices through the revelation of information, while Anderson et al. (Forthcoming) argue that the options market contains informed trade, as indicated by the changes in options-characteristics following the information-related regulations in Reg FD. Further, Anand and Chakravarty (2007) suggest that there is informed trading in the options market, as evidenced by stealth-trading-like characteristics of options trades. Meanwhile, there is evidence that stock returns are associated with options-characteristics, including put-call ratios (Pan and Poteshman, 2006), deviations from put-call parity (Cremers and Weinbaum, 2010), and implied volatility skew (Xing et al., 2010). Importantly for this study, Johnson and So (2012) show that stocks with higher O/S ratios experience lower returns in the next week, suggesting the presence of informed trade in the options market, as proxied by the O/S ratio.

Prior literature documents the presence of options trading activity around important corporate events. Cao et al. (2005) show that call option volume imbalance has a positive relation with target firm announcement returns in takeovers. Chan et al. (Forthcoming) find that implied volatility spread and implied volatility skew have significant predictability on acquirer announcement returns in mergers and acquisitions. Hao et al. (2013) suggest that while the put options market often does not dominate the short sale market in general, put options can contain information around negative earnings announcements. Other studies also provide evidence on the informational role of options trading around earnings announcements (Jin et al., 2012; Roll et al., 2010) and analyst-related news (Lin et al., 2013). Poteshman (2006) suggests that there was abnormal, and informed, options trading in the two airline companies (AMR, UAL) that were involved in the 11 September 2011 terrorist attacks. This

would suggest that the options market could be an attractive market for informed trade prior to bankruptcy filings. The prior literature yields several testable predictions, which we summarize in the following hypotheses.

**Hypothesis 1.** *Pre-bankruptcy insider stock trade predicts the stock return around the announcement of the bankruptcy filing.*

**Hypothesis 2.** *Pre-bankruptcy insider options trade predicts the stock return around the announcement of the bankruptcy filing.*

**Hypothesis 3.** *Pre-bankruptcy relative options trading volume predicts the stock return around the announcement of the bankruptcy filing.*

The predictive power of options trading is likely to increase with the liquidity of the options market (and decrease with the liquidity of the stock market). Easley et al. (1998) indicate informed investors may tend to trade in options market when options liquidity is high. Thus, the options market will become a less attractive venue of informed trade if they are less liquid. Therefore, we expect that the relationship between options trading and bankruptcy returns will become weaker as options become less liquid. Conversely, illiquidity in the stock market would make the options market a more attractive location of informed trade. We capture these predictions in the following hypothesis:

**Hypothesis 4.** *The relationship between bankruptcy returns and pre-bankruptcy options trade weakens with the illiquidity of the options market, but strengthens with the illiquidity of the stock market.*

The relationship between pre-bankruptcy options trade and bankruptcy announcement returns will be weaker if the market has already impounded bankruptcy-related information. Dawkins and Rose-Green (2003) indicate that there is often information-leakage before bankruptcy filings. This would manifest in negative pre-filing stock returns. These stock returns would weaken the relationship between options trading and announcement returns (as

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per Roll et al., 2010). For example Roll et al. (2010) find that the relationship between O/S and returns around earnings announcements weakens with pre-event stock returns. Thus, we have the following hypothesis:

**Hypothesis 5.** *The relationship between pre-filing options trade and returns around the filing is weakened by pre-filing trade in the stock market.*

# 3.   Data

This section introduces the source of the bankruptcy sample and options data, describes the sample selection procedure and provides summary statistics.

## 3.1.   Bankruptcy Data

We start by obtaining bankruptcy data from UCLA-LoPucki Bankruptcy Research Database.[7] During our sample period, there are 689 bankruptcy filings under Chapter 11 of the U.S. Bankruptcy Code. In order to analyze the bankruptcy announcement return, we first require the firms to have returns in the Center for Research in Security Prices (CRSP) from day $t-1$ to day $t$, where day $t$ is the filing date of bankruptcy. We also require accounting information from Compustat. We require the company to be listed at the time of the bankruptcy filing (i.e. the filing cannot post-date the firm delisting). These requirements restrict the sample size to 260 firms.

We next supplement this bankruptcy-sample with data on insider trading and pre-filing options trading. We gather data on insiders' pre-filing stock-trades and options-trades from

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[7]According to Subrahmanyam et al. (Forthcoming), there are several alternative data sources for bankrtupcy filings, such as the New Generation Research's "Public and Major Company Database", the Altman-NYU Salomon Center Bankruptcy List, Fixed Income Securities Database (FISD), and Moody's Annual Reports on Bankruptcy and Recovery. However, the additional sample mainly consists of private firms or smaller firms which tend not to have listed options. For our purpose, we decide to use UCLA-LoPucki Bankruptcy Research Database which covers most bankruptcy filings by large public firms.

Thomson Reuters insiders' transactions database. We separately analyze the relationship between bankruptcy-filing returns and insiders' total trade, their buys, sells, and net-sells, in the equities market. We supplement this stock-data with data on insiders' options trading. Requiring the company to have insider stock trading data reduces the sample to 131 observations. Requiring the company to have options data restricts the sample to 58 observations. We then examine pre-filing options trading in general. We obtain options trading data from OptionMetrics. Table 1 contains the variable definitions.

Table A.1 lists the firms in our sample that have options data, with their filing dates, firm names, and primary SIC codes. In general, our sample is neither concentrated in particular years nor biased to any particular industry. To examine the informational content of options trading prior to bankruptcy filings, we tautologically restrict our sample to contain only optioned firms. This does not introduce a sample selection bias; a company can have informed trade in the options market only if it has options (nonetheless, the optioned firms have similar firm-level characteristics to the non-optioned firms, as discussed in Section 3.6).

## 3.2. Insider Trade Data

We gather data on insider trades in the stock market and the options market from the Thomson Reuters insider trading database. According to the Securities and Exchange Commission (SEC), corporate insiders include directors, officers, and beneficial owners of more than 10% of a company's stock. They are required to file before the end of the second business day following the transaction date.[8]

The insider trading Table I contains stock (non-derivative) transactions and holdings information filed on Form 3, 4, and 5. The insider filing Table II contains derivative transactions and holdings information filed on Form 3, 4, and 5. Table II includes open market derivative transactions as well as award, exercise, and expiration of options. The insider

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[8]Before 2002, corporate insiders need to report to the SEC within 10 days after the end of month in which they make a transaction.

derivative trading data is available from January 1996, thus we start our sample from 1996.

For stock trading, if the transaction has an Acquisition/Disposition Code of A (D), we define it as an insider stock buy (sell) transaction. The net sell is defined as sell volume subtracted by buy volume. We also calculate the total volume from insider stock transactions. For each firm, we aggregate the total amount of insider stock buy, sell, and net sell volume, respectively, over the interval from day $t-252$ to day $t-2$, and then scale it by the total stock trading volume over this period.

For derivatives trading, we only retain transactions on options, which have the security title of call option (CALL), non-employee director stock option (DIREO), director's stock options (DIRO), employee stock option (EMPO), incentive stock option (ISO), non-qualified stock option (NONQ), options (OPTNS), or put option (PUT). We calculate the total volume in these categories from day $t-252$ to day $t-2$ and scale it by the total stock trading volume over this period, as the measure of insider options trading.

We use 250 days of data in order to capture the possibility that corporate insiders trade well before the bankruptcy announcement in order to mitigate concerns over violating insider trading laws. The results (unreported) are robust to using smaller event windows.

## 3.3. Options Data

We obtain daily options trading data from OptionMetrics. The data starts in 1996. Thus, the sample period begins in January 1996 and ends in December 2012. To capture informed options trading before bankruptcy filings, we adopt the O/S measure as in Roll et al. (2010) and Johnson and So (2012). O/S is defined as the ratio of options trading volume to stock trading volume. We include all call and put options when calculating trading volume.[9]

As documented in Roll et al. (2010), O/S is positively correlated with future absolute stock returns and can predict absolute returns around earnings announcement. Johnson and

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[9]We excluded options with time to expiration of less than 10 days or more than 60 days since they are relatively illiquid.

So (2012) find that O/S can predict future stock returns. They argue that most of the options trading comes from put options, thus the relationship between O/S and future returns is negative. In this paper, we also expect to find a similarly negative relation between O/S and bankruptcy announcement returns. Because bankruptcy events are significant negative news for firms, announcement returns are large and negative on average. Therefore, instead of using absolute returns, we just use the abnormal returns around filing dates. We conjecture that informed investors may trade more options prior to bankruptcy filings and O/S ratio will be negatively related to the announcement returns.

O/S has several advantages in the context of our study. Prior studies have used proxies such as "implied volatility spread" (Cremers and Weinbaum, 2010), and "implied volatility ('IV') skew" (Xing et al., 2010), which are derived from various measures of option trading. Chan et al. (Forthcoming) show that both measures have predictive power in relation to acquisition returns. However, both measures are based purely on trade in the options market. By contrast, O/S does provide an unsigned measure of the relative trading activity in the options market. This has three main advantages for our study. First, O/S enables us to examine the relative role of the options market compared with the stock market. Second, O/S enables us to explore whether informed traders prefer to trade in the options market as compared with the stock market (whereas the IV skew and IV spread measures would not capture such a shift). Third, both IV skew and IV spread impose further data restrictions on the sample, which would further reduce the sample size.

## 3.4.  Announcement Returns

We use the compound abnormal return from day $t-1$ to day t as the announcement return, where day t is the bankruptcy filing date. One reason to use a two-day return is that a significant proportion of firms do not have CRSP returns immediately after the filing. If we include day $t+1$ return, the sample size is further limited to 42 (although the results are qualitatively similar if we restrict the sample to these 42 observations and examine the

three-day return). Further, we conjecture that if informed traders hold private information on the upcoming bankruptcy filing, they should be aware of the filing date and also the fact that the stock price will drop dramatically immediately after the announcement. They may not be interested in the return on day $t+1$ since many firms stop trading on that day. Therefore, the trading activity and the market reaction on or immediately before the filing date should be most relevant to us.

In calculating the announcement return, we use buy-and-hold abnormal returns (BHARs) instead of cumulative abnormal returns (CARs). This is due to the abnormal market response around bankruptcy announcements. As mentioned in Seyhun and Bradley (1997), the stock prices of many bankruptcy firms fall into single digits. A small change in price can lead to a large fluctuation in stock return. Using CAR may lead to unreasonable numbers in returns. For example, if the price falls from $10 to $5 and then rises to $10, then the cumulative return will be -50% +100% = +50%. By contrast, the buy and hold return will be 0%. As a result, we adopt BHAR to better capture the holding period return in all analyses throughout our paper. The benchmark for calculating abnormal returns is the buy-and-hold return of the CRSP value-weighted market return for the same period. The results are robust to using CARs instead of BHARs or to using the CRSP equally weighted index instead of the value weighted index.

## 3.5. Other Characteristics

We also obtain data on several firm characteristics. We calculate the pre-month return as the compound return earned over the month before the filing, i.e., from day $t-23$ to day $t-2$. We follow Baker and Wurgler (2004) and Baker et al. (2009), and calculate size and book-to-market (B/M) ratio based on data at the most recent fiscal year end before bankruptcy filing. Both are in natural logarithm. We calculate the firm-value by multiplying the end-of-year stock price by the number of shares outstanding. Book equity is stockholders equity (or first available of common equity plus preferred stock par value or book assets minus liabilities)

minus the preferred stock liquidating value (or first available of redemption value or par value) plus balance sheet deferred taxes and investment tax credits if available and minus post-retirement assets if available. The B/M ratio is then book assets divided by book assets minus book equity plus market equity.[10] The turnover rate is the total stock trading volume divided by the number of shares outstanding. We use the average turnover for pre-filing month, i.e., from day $t-23$ to day $t-2$. Comparing between Panel A and Panel B of Table 1, there is little difference between our sample and general bankruptcy firms in terms of these firm characteristics.

[Insert Table 1 about Here]

## 3.6. Summary Statistics

The summary statistics are in Table 2. As summarized in Table 2 Panel A, the mean O/S ratio is 0.02 and its standard deviation is 0.03 for our sample firms. As shown in Panel A of Table 2, our optioned sample firms have a mean return of $-28\%$ around bankruptcy announcements. It is lower than that of general bankruptcy firms which have a mean return of $-12\%$ as shown in Panel B. The standard deviation of BHARs in the optioned-sample is 0.39, which is smaller than that for general bankruptcy firms. The general corporate-characteristics of the optioned firms are similar to those of the non-optioned firms. Panel A of Table 2 summarizes the firm characteristics of the sample firms, which are required to have CRSP, Compustat, and options data. As a comparison, Panel B contains summary statistics for all bankruptcy firms with CRSP and Compustat data, but not necessarily options trading data.

[Insert Table 2 about Here]

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[10]Some firms have negative book equity. Therefore, B/M ratio of equity has missing values when we take logarithm. We thus use B/M ratio of asset and make the variable definition consistent through out the paper. In later regressions, we also control for B/M ratio of asset, but using B/M ratio of equity does not alter our finding.

Before any discussion about informed options trading, we would like to better understand the pattern of stock returns around bankruptcy announcements. Figure 1 shows the equal-weighted average daily abnormal return from day $t - 30$ to day $t + 1$ (the results are robust to using a value-weighted average). We use CRSP market value-weighted return as the benchmark when calculating abnormal returns. Figure 1a is for our sample optioned firms, and Figure 1b is for all bankruptcy firms without restrictions on options trading. The daily returns are almost always negative during this period. However, the returns do not significantly decrease until one or two days before the filing date. The stock price drops dramatically on the filing date. It seems that the market does not fully anticipate the bankruptcy announcement; and thus, the stock return does not reflect this information before the announcement. In this sense, if pre-filing options trading contains information on bankruptcy returns, it would reflect informed trading in options market.

[Insert Figure 1 about Here]

In Figure 2, we plot equally weighted average BHAR for our sample firms and for all bankruptcy firms from day $t - 30$ to day $t + 1$ (the results are robust to using a value-weighted average). On each day, we compound stock returns from day $t - 30$ to that day, as each firm's buy-and-hold return. We use the compound CRSP market value-weighted return as the benchmark in calculating BHARs. Consistent with expectations, average BHARs decrease gradually from 30 days before the filing and drop significantly on the filing date. The pattern for our sample is similar to that for the full set of bankruptcy firms (that need not have options data).

[Insert Figure 2 about Here]

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# 4.  Analysis

## 4.1.  Pre-filing Insider Trade and Bankruptcy Filing Returns

We start by analyzing the relationship between pre-bankruptcy insider trade and bankruptcy-filing returns. The results are in Table 3. Prior literature presents mixed findings on the presence between pre-filing trade in the stock market, typically finding only limited evidence of pre-filing insider stock-trade. If there is significant pre-bankruptcy insider-trade, then it should be significantly related to the returns earned around the bankruptcy-filing. We analyze total insider stock-trade, buys, sells, and net sells. We run OLS regressions where the dependent variable is two-day BHAR earned on the firm's bankruptcy-filing from day $t-1$ to day $t$. None of the insider stock-trade variables are significantly related to bankruptcy-filing returns. Thus, Hypothesis 1 is not supported. This is not surprising given that there is only weak evidence in the prior literature on the presence of insider stock-trade prior to bankruptcy findings.

[Insert Table 3 about Here]

We next examine pre-filing insider options-trade. We do this by running the same regression specification as in Table 3, but with the addition of the insider options-trade variable. The results are in Table 4. We find that pre-filing options trading is significantly and negatively related to bankruptcy-filing returns. Pre-filing insider stock-trade remains insignificantly related to filing returns. This result tends to suggest that insider options-trade conveys useful information about the bankruptcy-event, supporting Hypothesis 2. Overall, when read together with the insider stock-trade results, these findings indicate that informed insiders trade in the options market, rather than the stock market, prior to bankruptcy filings.

[Insert Table 4 about Here]

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## 4.2.  O/S and Bankruptcy Filing Returns

This section examines the relationship between O/S and bankruptcy filing returns. Hypothesis 3 argues that informed traders prefer to trade in the options market; and thus, O/S will be negatively related to bankruptcy filing returns. We test our hypothesis by examining the relationship between the two-day BHAR from day $t-1$ to day $t$ and the O/S ratio computed over the days $t-4$ to $t-2$. We control for the amount of insider options trading and for insider net sells (the results are qualitatively similar if we control for buys, sells, or total trade).

The results are in Table 5. Models one to four add progressively more control variables. The coefficient on O/S is negative and statistically significant, ranging from -3.17 to -3.63 at 1% significance. This result is economically significant: A one standard deviation increase in O/S is associated with a 10.84 percentage point reduction in filing returns. These results suggest that a significant portion of pre-filing informed trade occurs in the options market relative to the stock market. The results support the foregoing finding that insiders prefer to trade in the options market rather than the stock market.

[Insert Table 5 about Here]

## 4.3.  The Role of Options and Stock Liquidity

We next analyze whether the option-market liquidity influences the predictive power of informed options trading. We expect that the options market will be less attractive to informed traders if it is more illiquid. We measure options liquidty by using options bid-ask spread, which is the average bid-ask spread for all options on the firm's equity from day $t-7$ to day $t-5$.[11] The interaction term of O/S and options bid-ask spread captures the additional effect of options liquidity on the predictability of O/S on bankruptcy announcement returns.

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[11]We use lagged bid-ask spread to avoid the overlap with O/S measure since the options trading will be affected by contemporaneous bid-ask spread.

Similarly, we also examine stock market illiquidity, as proxied by the bid-ask spread in the stock market.

We present the regression results in Table 6, where the dependent variable is the two-day BHAR from $t - 1$ to $t$. As shown in the model with all controls, Model 4, O/S still has a significant and negative relation with bankruptcy announcement returns. Moreover, the coefficient on the interaction of O/S with the options bid-ask spread is positive and statistically significant. It indicates that when the firm has a higher options bid-ask spread, i.e., has lower options liquidity, O/S will have a weaker relationship with bankruptcy filing returns. The interaction of O/S with the stock bid-ask spread is negative but statistically insignificant, suggesting that stock-market liquidity (i.e. the ease of trading in the stock market) only weakly reduces informed traders' preferences for trading in the options market.

[Insert Table 6 about Here]

## 4.4. The Impact of Pre-bankruptcy Returns

This section examines how pre-filing stock returns influence the relationship between O/S and returns around the bankruptcy-filing. Dawkins and Rose-Green (2003) suggests that there is often information leakage prior to bankruptcies, which can lead to equity-trading and reduce the scope for informed traders to profit in the options market. Thus, Roll et al. (2010) suggests that O/S's predictive power decreases with the presence of pre-event trade around earnings announcements. To capture the effect of pre-announcement return, we compute the firm's buy-and-hold return from day $t - 7$ to day $t - 5$. We then interact this "prior return" variable with O/S and with the insider options-trade variable.

Table 7 shows the cross-sectional regression results that examine the impact of pre-bankruptcy stock returns. There are several key findings. First, filing returns are still significantly and negatively related to O/S and insider options trading. Second, The interaction terms are significant and negative. This means that if the pre-filing stock return is more negative, O/S (or insider options trading) will be less negatively related to filing returns.

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Overall, the results suggest that if information is already impounded into the stock-price, then options trade will be less informative.

[Insert Table 7 about Here]

## 4.5. Additional Robustness Checks

We undertake several additional robustness tests, including pseudo-event simulations, in order to mitigate additional econometric concerns.

### 4.5.a. Simulations on Pseudo-bankruptcy Events

The foregoing results suggest that insider options trading and O/S can predict returns around bankruptcy filings. We argue that this is because informed traders trade in the options market around bankruptcy filings. However, an alternative explanation could be that these companies ordinarily feature more informed trade in the options market; and thus, the negative O/S-return relationship is not special for bankruptcies. To exclude this possibility, and to address identification concerns, we conduct simulations around pseudo-bankruptcy events. These simulations are of the nature of placebo tests (see e.g. Erel et al., Forthcoming), where we examine the predictive ability of O/S (and insider options trading) on non-filing days and/or for non-filing firms.

We use three different methods in selecting pseudo-bankruptcy events. In method 1, for each of our sample firms, we randomly select a non-filing date as the pseudo-filing date, from all days with options data for that firm. In method 2, on each bankruptcy filing date in our sample, we randomly choose a non-filing firm as the pseudo-bankruptcy firm on that day. In method 3, we randomly select a non-filing firm on a non-filing date as the pseudo-event, from the pool of all firms with options data. After that, we calculate the two-day $(t-1, t)$ BHAR as the return around pseudo-bankruptcy events. We then replicate the models that analyze insider options trading and O/S (i.e. Table 4 Column 4 and Table 5 Column 4, respectively). For insider options trading, we regress the BHAR on the insider

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options trading from day $t - 252$ to day $t - 2$ and relevant controls. Similarly, for O/S, we regress the BHAR on the three day O/S from day $t - 4$ to day $t - 2$ and the controls in Table 5 Column 4. For each method, we then run 1,000 regressions of 58 observations (i.e. the same number of observations as in baseline regressions). We then calculate the average coefficient and t-statistic for the O/S coefficient.

This simulation approach has some advantages over alternative approaches. We take this simulation approach as opposed to simply looking at the O/S (or insider options trading) for the whole market because we want to maintain a similar sample size in each regression in order to ensure the results are comparable to the foregoing baseline results. Further, we select random non-bankrupt firms in method 2 and method 3, rather than industry (etc) matched firms in order to avoid the risk of cross-sectional contamination from the bankrupt firm onto directly related firms.

Table 8 summarizes the simulation results. Panel A presents simulation evidence in relation to insider options trading (i.e. simulations related to Table 4 Column 4), and Panel B presents results for the O/S coefficient (i.e. simulations related to Table 5 Column 4). As a comparison, we also list the relevant Insider Options Trading and O/S coefficients in our baseline regression in the column of "original" in each panel. The correlation between announcement returns and both insider options trading and O/S is stronger for the actual bankruptcy-filing events than in pseudo-events. For example, using method 3, O/S has an average coefficient of -0.01 (t-statistic = -2.52), which is smaller than original coefficient of -3.17 in Table 5. Thus, although O/S still has negative and significant predictability on pseudo-announcement returns, the magnitude is small. For these simulations, we also calculate the fraction of trials in which the O/S coefficient, or the insider options trading coefficient, is greater-in-absolute-magnitude than that in our original regression. Importantly, for all simulations, we find that no trial has a larger coefficient than our original regression. The simulation analysis confirms that our results are consistent with previous studies that O/S has some predictability on future returns. However, more importantly, this relationship

is significantly stronger around actual bankruptcy filing dates.

[Insert Table 8 about Here]

### 4.5.b.   Change in O/S and O/S Timing

The foregoing models examine the relationship between the *level* of O/S and filing-returns. To ensure that the results are not merely an artefact of the sample-companies having a high-level of O/S we also examine changes in O/S from a pre-filing benchmark period. Following Johnson and So (2012), we use the O/S from day $t - 200$ to $t - 100$ as the benchmark, and calculate change in O/S as the difference between O/S from $t-4$ to $t-2$ and the benchmark O/S. That is, $\Delta$O/S = O/S$(t - 4, t - 2)$ – O/S$(t - 200, t - 100)$. The results are in Model 1 of Table 9. The main finding is that $\Delta$O/S is negatively related to filing-returns (at 10% significance). The results suggest that an increase in O/S has a significant and negative association with bankruptcy announcement returns.

In Model 2 of Table 9, We further examine the relationship between filing-returns and O/S on day $t - 2$ (where we compute returns from day $t - 1$ to day $t$). We expect, and find, that the coefficient on O/S$(t-2)$ is significantly and negatively related to filing-returns. The coefficient is similar in magnitude to the coefficients on O/S$(t-4, t-2)$ reported in Table 5.

### 4.5.c.   BHAR-definition

We ensure that the results are robust to using different BHAR windows. The baseline results (i.e. Table 5) examine the two-day BHAR from day $t - 1$ to day $t$. Many of the firms delist after day $t$. Nonetheless, Models 3 and 4 of Table 9 examine BHARs over the windows $(t - 1, t + 1)$ and $(t, t + 1)$, respectively. Model 5 of Table 9 examines the abnormal return on day $t$.

The finding is that the relationship between O/S and all BHAR definitions is similar in both magnitude and statistical significance to those in the main models (Table 5). Indeed, the coefficient on O/S in all of Models 3-5 of Table 9 is larger in magnitude than is the

coefficient on O/S in the main models in Table 5. These results suggest that the results are robust to BHAR window.

### 4.5.d. Short Interest

We check that the results are robust to controlling for short interest and/or to restricting the sample to contain only companies that have short interest. One possibility is that informed traders could also trade in the equity market by shorting the company's stocks (see e.g. Boehmer et al., 2010, 2008, 2013; Boehmer and Wu, 2013; Diether et al., 2009; Hao et al., 2013). For example, Blau and Tew (2014) argue that short sales increase prior to securities class actions, which would have similarly negative implications to bankruptcy announcements. This would lessen the role of the (put) options market as a venue for informed trade. Further, for companies that lack short interest, the options market would the the most plausible venue for informed trade. Additionally, the presence of a short-sale market can contribute to the liquidity of the options market, as put-option-writers can use short sales to hedge their risk and the absence of a short-sale market can drive more informed trade to the put-option-market, thereby increasing option bid-ask spreads (see e.g. Battalio and Schultz, 2011; Grundy et al., 2012). Subsequently, we also ensure that the results are robust to restricting the sample to comprise firms that have short interest and to controlling for that short interest.

The results are in Model 6 of Table 9. The main finding are that O/S is still negatively related to the returns earned around the bankruptcy filing. Further, short interest is significantly negatively related to filing-returns, consistent with the idea that informed traders will short the company's stock prior to the bankruptcy filing. These results are consistent with the finding in Hao et al. (2013) that while short sales often contain more information than put-trades, the put options market has more information around negative earnings announcements (i.e. around negative events).

[Insert Table 9 about Here]

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### 4.5.e. Other Sources of "Bankrupt" Firms

This study uses a sample of companies that file for bankruptcy while listed. An alternative is to examine companies who delist for bankruptcy-related reasons. Our original sample has the advantage of avoiding the possibility that pre-delisting short-selling actually contributes to the delisting by reducing the stock price and causing it to breach minimum price rules. We identify these delistings as ones that are recorded with delisting codes 400-499 and 573 in CRSP. This provides a sample of 52 delisting observations (where the firms have the requisite options data). We examine the return earned over day $t-1$ to day $t$ around the delisting.

We produce three sets of results in Table 10. Columns 1 and 2 examine the set of 52 delisting events from CRSP. The dependent variable is the two-day BHAR from day $t-1$ to day $t$. Columns 3 and 4 take the original set of 58 companies that file for bankruptcy. CRSP reports that an additional 21 companies delist for liquidation/bankruptcy reasons. We combine these 21 observations with the original 58 observations. For the original 58 observations, we use the same data as in the baseline regressions. For the additional 21 observations, we gather return and O/S data from around the delisting. In this sample, each company can only account for one observation. The third set of results is in Columns 5 and 6. Here, we combine the original 58 observations (where we gather data from around the filing) with the additional 52 delistings (where we gather data from around the delisting). In this sample, a company can appear in two observations.

The results, in Table 10, are consistent with the previously reported results. O/S is negatively and significantly related to returns around the delisting (in Columns 1 and 2). This result continues to hold in Columns 3 and 4, and in Columns 5 and 6, where we combine the original bankruptcy-filing sample with the delisting sample. The coefficients in all models are of a similar magnitude to those in the baseline models. This suggests that options trading has predictive power around bankruptcy-related delistings in addition to bankruptcy filings.

[Insert Table 10 about Here]

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### 4.5.f.    Other Robustness Tests

The results are robust to variable definition issues (these results are untabulated for brevity). The results hold if we use CARs instead of BHARs to compute the bankruptcy filing returns. The reported results are based on BHARs that use a value-weighted market index. The results are robust to using an equally-weighted market index.

The results are robust to time effects and industry effects. The sample contains 58 bankruptcy filing observations that are evenly dispersed across time and industry. This makes it difficult to control for year and industry fixed effects without both significantly reducing the degrees of freedom and creating collinearity between the firm-level variables and the fixed effects. Nonetheless, the results are robust to excluding bankruptcies that occur during the financial crisis years (2008, 2009). The results are also robust to using the full sample and including a dummy for whether the bankruptcy filing occurs during 2008 or 2009. Excluding such bankruptcies reduces the sample size by 12 observations. The results are also qualitatively similar if we include SIC one digit industry dummies. This is unsurprising given that the sample is relatively evenly dispersed across time. The evidence from the simulation tests also helps to mitigate concerns about time effects; specifically, as indicated above, O/S has much lower predictive power on the filing dates for the set of simulation-selected non-filing firms, suggesting that the predictive ability of O/S is not merely a time-effect.

## 5.    Conclusion

The prior literature on pre-bankruptcy informed-trade has focused on insider (i.e. top executive) trading in the equities and has tended to show limited evidence of pre-filing insider stock-trade. While there is some evidence that insiders trade equity prior to bankruptcy filings (Seyhun and Bradley, 1997), other evidence suggests that pre-bankruptcy insider trading is not significantly different from insider trading at industry-size matched control

firms (Gosnell et al., 1992). One reason for the lack of evidence on pre-filing insider (or informed) trade could be the focus on the equities market as opposed to the options market.

We contribute to the literature by examining the presence of pre-bankruptcy insider-trade and informed-trade in the options market. Prior studies suggest that informed traders sometimes trade in the options market prior to the announcement of corporate events, such as takeovers (Cao et al., 2005; Chan et al., Forthcoming). Subsequently, we analyze the presence of insider trade prior to bankruptcy filings. We also use a similar framework to that in Roll et al. (2010) and Johnson and So (2012) to examine the role of pre-bankruptcy informed trade in the options market. We test the relationship between the pre-filing ratio of options trade to stock trade (O/S) and returns around the announcement of the filing.

We start by analyzing pre-filing insider stock trading and options trading. In our sample, pre-filing insider stock trading is not significantly related to bankruptcy filing returns. By contrast, pre-filing insider options trading is significantly negatively related to filing returns. This suggests that informed insiders tend to trade in the options market rather than the stock market.

We then explore the presence of pre-filing informed trade (as opposed to insider trade). We find a negative relationship between filing announcement returns and both the *level* of O/S and the *change* in O/S from a pre-bankruptcy "benchmark" period. We support these results with simulations using pseudo-bankruptcy events, in which we examine the predictive ability of O/S for (1) the set of bankruptcy-firms in a non-bankruptcy period, (2) a set of non-bankruptcy firms on the bankruptcy filing dates, and (3) a set of non-bankruptcy firms on non-filing days. We find that while O/S still predicts stock returns in these simulation results; however, the predictive ability is significantly lower than it is for the bankruptcy sample. This is consistent with the idea that informed traders often trade in the options market and options trade can predict stock returns in general (Johnson and So, 2012; Roll et al., 2010), but this informed trade increases prior to bankruptcy announcements. We also find that informed trade in the options market decreases with the options market's illiquidity

and with the amount of information that is already impounded into stock prices.

The results contribute to the literature in several ways. Examining insider trade and informed trade in the options market helps to reconcile the mixed evidence (in the equities market) on the presence of pre-filing insider trade. We highlight that there is indeed pre-filing insider and informed trade, but that it concentrates in the options market rather than the stock market. We also contribute to the literature on the location of informed trade by highlighting that the options market is one location of informed trade prior to a significant corporate event. The results have regulatory-implications for the analysis of trading activity prior to bankruptcy events.

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# Tables

<div align="center">

**Table 1: Variable Definitions**

</div>

| Variable | Definition |
|---|---|
| $\mathrm{BHAR}(t - \tau_1, t + \tau_2)$ | The buy and hold abnormal return over the interval from day $t - \tau_1$ to day $t + \tau_2$. The abnormal return on a given day is the return earned on the stock less the return earned on the CRSP value-weighted index. In the main reported results we use the window from day $t - 1$ to day $t$. |
| O/S | Defined as in Roll et al. (2010): This is the total options trading volume divided by the total stock trading volume over the days $t - 4$ to $t - 2$, where day $t$ is the day of the bankruptcy filing. |
| $\Delta$ O/S | The change in O/S from a pre-event period to the pre-filing period. Specifically $\Delta\mathrm{O/S} = \mathrm{O/S}(t - 4, t - 2) - \mathrm{O/S}(t - 200, t - 100)$, where $\mathrm{O/S}(\tau_1, \tau_2)$ is the total options trading scaled by the total stock trading between day $\tau_1$ and day $\tau_2$. |
| Insider options trading | The total insider options trading from the Thomson Reuters insider trading database scaled by the total amount of stock trading. This is computed from day $t - 252$ to $t - 2$. |
| Insider stock total | The total insider stock trading from the Thomson Reuters insider trading database scaled by the total amount of stock trading. This is computed from day $t - 252$ to $t - 2$. |
| Insider stock buy | The total insider stock-buys from the Thomson Reuters insider trading database scaled by the total amount of stock trading. This is computed from day $t - 252$ to $t - 2$. |
| Insider stock sell | The total insider stock-se;;s from the Thomson Reuters insider trading database scaled by the total amount of stock trading. This is computed from day $t - 252$ to $t - 2$. |
| Insider stock net sell | The total insider net sells from the Thomson Reuters insider trading database scaled by the total amount of stock trading. This is computed from day $t - 252$ to $t - 2$. |
| Pre-month return | The buy and hold return from day $t - 23$ to day $t - 2$ where day $t$ is the day of the bankruptcy filing. |
| Size | The natural log of the year-end stock price (CRSP/Compustat: prcc_f) multiplied by the shares outstanding (Compustat: csho). |
| B/M | The natural log of the firm's book-to-market. The book-to-market is the firm's total assets (Compustat: at) scaled by its market value of assets. The market value of assets is the firm's book assets less its book equity (Compustat: ceq) plus its market capitalization. |

| | |
|---|---|
| Turnover | The average total stock trading volume divided by the number of shares outstanding for day $t-23$ through to day $t-2$. The data is from CRSP. |
| Prior return | The compounded return from day $t-7$ to day $t-5$, where day $t$ is the day of the bankruptcy filing. The data is from CRSP. |
| Options bid-ask spread | The average bid-ask spread for all options on the firm's equity from day $t-7$ to day $t-5$. |
| Stock bid-ask spread | The average bid-ask spread on the firm's stock from day $t-7$ to day $t-5$. |
| Short interest | The short interest from Compustat from the month prior to the bankruptcy filing. |

**Table 2: Summary Statistics for Bankruptcy Firms**

This table summarizes the characteristics of firms which filed for bankruptcy from 1996 to 2012. Panel A shows our final sample where we require the firms to have returns on day $t-1$ to day $t$ in CRSP, accounting information from Compustat, and options trading data from OptionMetrics before bankruptcy filings. Panel B shows all bankruptcy firms with CRSP and Compustat data, but not necessarily options trading. Table 1 contains the variable definitions.

|  | No. Obs | Mean | Std | Q1 | Median | Q3 |
|---|---|---|---|---|---|---|
| Panel A: Sample with options data | | | | | | |
| BHAR | 58 | -0.2754 | 0.3934 | -0.6506 | -0.2287 | -0.0542 |
| Pre-month return | 58 | -0.3477 | 0.6215 | -0.6800 | -0.3897 | -0.1862 |
| Size | 58 | 5.7353 | 1.8207 | 4.4853 | 5.5338 | 6.8215 |
| B/M | 58 | -0.0730 | 0.2732 | -0.1342 | -0.0375 | 0.0562 |
| Turnover | 58 | 0.0487 | 0.0398 | 0.0158 | 0.0335 | 0.0695 |
| O/S | 58 | 0.0194 | 0.0342 | 0.0000 | 0.0008 | 0.0226 |
| Insider options trading | 58 | 0.0033 | 0.0068 | 0.0000 | 0.0008 | 0.0025 |
| Insider stock total | 58 | 0.0075 | 0.0171 | 0.0004 | 0.0009 | 0.0044 |
| Insider stock buy | 58 | 0.0055 | 0.0152 | 0.0002 | 0.0005 | 0.0017 |
| Insider stock sell | 58 | 0.0021 | 0.0054 | 0.0000 | 0.0001 | 0.0011 |
| Insider stock net sell | 58 | -0.0034 | 0.0152 | -0.0008 | -0.0001 | 0.0001 |
| Panel B: All bankruptcy firms with CRSP and Compustat Data | | | | | | |
| BHAR | 241 | -0.1194 | 0.7554 | -0.3778 | -0.1075 | -0.0031 |
| Pre-month return | 252 | -0.3085 | 0.4784 | -0.6522 | -0.3680 | -0.1187 |
| Size | 168 | 4.5792 | 1.7010 | 3.5426 | 4.4283 | 5.4853 |
| B/M | 166 | -0.0094 | 0.2323 | -0.0918 | -0.0088 | 0.0902 |
| Turnover | 252 | 0.0272 | 0.0359 | 0.0055 | 0.0147 | 0.0316 |
| Insider options trading | 260 | 0.0081 | 0.0266 | 0.0000 | 0.0003 | 0.0045 |
| Insider stock total | 260 | 0.0858 | 0.9828 | 0.0001 | 0.0020 | 0.0146 |
| Insider stock buy | 260 | 0.0402 | 0.4908 | 0.0000 | 0.0007 | 0.0054 |
| Insider stock sell | 260 | 0.0456 | 0.4942 | 0.0000 | 0.0001 | 0.0033 |
| Insider stock net sell | 260 | 0.0054 | 0.0664 | -0.0015 | 0.0000 | 0.0003 |

## Table 3: Pre-bankruptcy Insider Stock Trading and Bankruptcy Returns

This table presents the cross-sectional regression results of bankruptcy announcement returns on pre-filing insider stock trading and other control variables. The dependent variable is the two-day $(t-1, t)$ buy-and-hold abnormal return (BHAR) where day $t$ is the bankruptcy filing date, and we use the compounded CRSP value-weighted market return as the benchmark. Table 1 contains the variable definitions. Parentheses contain $t$-statistics. The t-statistics are computed using White (1980) heteroskedasticity robust standard errors, and ***, **, and * indicate significance at 1%, 5%, and 10% level respectively.

| Model | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Insider stock total | 0.01 | | | |
| | (1.17) | | | |
| Insider stock buy | | 0.01 | | |
| | | (1.42) | | |
| Insider stock sell | | | 0.01 | |
| | | | (0.91) | |
| Insider stock net sell | | | | -0.16 |
| | | | | (-0.64) |
| Pre-month return | -0.16 | -0.16 | -0.16 | -0.16 |
| | (-1.22) | (-1.23) | (-1.22) | (-1.22) |
| Size | 0.03 | 0.03 | 0.03 | 0.03 |
| | (0.64) | (0.64) | (0.64) | (0.62) |
| B/M | 0.39 | 0.39 | 0.39 | 0.39 |
| | (1.36) | (1.36) | (1.36) | (1.34) |
| Turnover | -3.42* | -3.42* | -3.43* | -3.46* |
| | (-1.95) | (-1.95) | (-1.95) | (-1.98) |
| Intercept | -0.23 | -0.23 | -0.23 | -0.22 |
| | (-1.27) | (-1.27) | (-1.27) | (-1.23) |
| N | 131 | 131 | 131 | 131 |
| R-squared | 0.027 | 0.027 | 0.027 | 0.027 |

**Table 4: Pre-bankruptcy Insider Options Trading and Bankruptcy Returns**

This table presents the cross-sectional regression results of bankruptcy announcement returns on pre-filing insider options trading, and other control variables. The dependent variable is the two-day $(t-1, t)$ buy-and-hold abnormal return (BHAR) where day $t$ is the bankruptcy filing date, and we use the compounded CRSP value-weighted market return as the benchmark. Table 1 contains the variable definitions. Parentheses contain $t$-statistics. The t-statistics are computed using White (1980) heteroskedasticity robust standard errors, and ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

| Model | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Insider options trading | -19.08*** | -18.96*** | -18.81*** | -18.99*** | -18.67*** |
| | (-3.13) | (-3.04) | (-3.00) | (-3.09) | (-2.98) |
| Insider stock total | | 0.73 | | | |
| | | (0.38) | | | |
| Insider stock buy | | | 1.40 | | |
| | | | (0.71) | | |
| Insider stock sell | | | | -3.60 | |
| | | | | (-0.60) | |
| Insider stock net sell | | | | | -1.94 |
| | | | | | (-1.05) |
| Pre-month return | -0.18** | -0.18** | -0.18** | -0.19** | -0.19** |
| | (-2.51) | (-2.46) | (-2.53) | (-2.39) | (-2.58) |
| Size | -0.04 | -0.04 | -0.04 | -0.04 | -0.04 |
| | (-1.10) | (-1.12) | (-1.16) | (-1.12) | (-1.21) |
| B/M | 0.06 | 0.05 | 0.05 | 0.05 | 0.04 |
| | (0.24) | (0.23) | (0.21) | (0.21) | (0.18) |
| Turnover | -2.22* | -2.15 | -2.06 | -2.17* | -1.97 |
| | (-1.84) | (-1.65) | (-1.57) | (-1.81) | (-1.52) |
| Intercept | 0.07 | 0.07 | 0.07 | 0.08 | 0.07 |
| | (0.35) | (0.33) | (0.33) | (0.38) | (0.34) |
| N | 58 | 58 | 58 | 58 | 58 |
| R-squared | 0.191 | 0.192 | 0.194 | 0.194 | 0.196 |

**Table 5: O/S and Bankruptcy Filing Returns**

This table presents the cross-sectional regression results of bankruptcy announcement returns on pre-filing options to stock trading volume ratio (O/S) and other control variables. The dependent variable is the two-day $(t-1, t)$ buy-and-hold abnormal return (BHAR) where day $t$ is the bankruptcy filing date. Table 1 contains the variable definitions. Parentheses contain $t$-statistics. The t-statistics are computed using White (1980) heteroskedasticity robust standard errors, and ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

| Model | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| O/S | -3.63*** | -3.88*** | -3.49*** | -3.17** |
|  | (-3.05) | (-3.13) | (-3.01) | (-2.50) |
| Insider options trading | -16.04*** | -16.57*** | -17.37*** | -19.54*** |
|  | (-3.13) | (-3.35) | (-3.10) | (-3.34) |
| Insider stock net sell | -1.84 | -2.44 | -2.55 | -1.56 |
|  | (-0.97) | (-1.26) | (-1.37) | (-0.80) |
| Pre-month return |  | -0.14** | -0.17*** | -0.17** |
|  |  | (-2.23) | (-2.68) | (-2.51) |
| Size |  |  | -0.02 | -0.01 |
|  |  |  | (-0.57) | (-0.29) |
| B/M |  |  | 0.14 | 0.16 |
|  |  |  | (0.55) | (0.66) |
| Turnover |  |  |  | -1.50 |
|  |  |  |  | (-1.13) |
| Intercept | -0.16** | -0.20*** | -0.09 | -0.07 |
|  | (-2.24) | (-3.31) | (-0.43) | (-0.33) |
| N | 58 | 58 | 58 | 58 |
| Adj. R-square | 0.1089 | 0.1454 | 0.1385 | 0.1390 |

**Table 6: The Role of Options Liquidity**

This table shows the cross-sectional regression results of bankruptcy announcement return on O/S and its interaction with pre-filing options stock bid-ask spread. The dependent variable is the two-day $(t-1, t)$ buy-and-hold abnormal return (BHAR) where day $t$ is the bankruptcy filing date, and we use the compounded CRSP value-weighted market return as the benchmark. Table 1 contains the variable definitions. Parentheses contain t-statistics. The $t$-statistics are computed using White (1980) heteroskedasticity robust standard errors, and ***, **, and * indicate significance at 1%, 5%, and 10% level respectively.

| Model | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| O/S | -9.57*** | -9.72** | -8.08** | -8.09* |
| | (-2.89) | (-2.40) | (-2.02) | (-1.75) |
| Insider options trading | -14.73*** | -16.18*** | -12.71** | -13.77** |
| | (-2.69) | (-2.73) | (-2.64) | (-2.55) |
| Insider stock net sell | -1.55 | -1.70 | -2.45 | -2.39 |
| | (-0.77) | (-0.85) | (-1.17) | (-1.10) |
| O/S*Options bid-ask spread | 8.87** | 8.85* | 8.72** | 8.50* |
| | (2.08) | (1.81) | (2.12) | (1.74) |
| Options bid-ask spread | -0.16 | -0.31 | -0.15 | -0.34 |
| | (-0.85) | (-1.46) | (-0.77) | (-1.59) |
| O/S*Stock bid-ask spread | | | -5.78 | -6.07 |
| | | | (-0.39) | (-0.44) |
| Stock bid-ask spread | | | 0.66 | 0.68 |
| | | | (1.46) | (1.38) |
| Pre-month return | | -0.19*** | | -0.13** |
| | | (-2.77) | | (-2.39) |
| Size | | -0.02 | | -0.03 |
| | | (-0.48) | | (-0.59) |
| B/M | | 0.17 | | 0.26 |
| | | (0.67) | | (1.14) |
| Turnover | | -1.01 | | -0.98 |
| | | (-0.69) | | (-0.69) |
| Intercept | -0.01 | 0.25 | -0.17 | 0.18 |
| | (-0.05) | (0.68) | (-0.81) | (0.47) |
| N | 58 | 58 | 58 | 58 |
| R-square | 0.190 | 0.280 | 0.270 | 0.350 |

**Table 7: The Impact of Pre-bankruptcy Return**

This table shows the cross-sectional regression results of bankruptcy announcement returns on O/S and its interaction with pre-filing returns. The dependent variable is the two-day $(t-1, t)$ buy-and-hold abnormal return (BHAR) where day $t$ is the bankruptcy filing date, and we use the compounded CRSP value-weighted market return as the benchmark. Table 1 contains the variable definitions. Parentheses contain $t$-statistics. The $t$-statistics are computed using White (1980) heteroskedasticity robust standard errors, and ***, **, and * indicate significance at 1%, 5%, and 10% level, respectively.

| Model | 1 | 2 | 3 |
|---|---|---|---|
| O/S | | -4.37*** | -4.32*** |
| | | (-3.55) | (-3.44) |
| O/S*Prior return | | -9.01** | -9.03** |
| | | (-2.51) | (-2.40) |
| Insider options trading | -23.52*** | -24.39*** | -23.91*** |
| | (-3.99) | (-4.42) | (-4.26) |
| Insider options trading*Prior return | -37.49* | -36.25** | -36.06* |
| | (-1.76) | (-2.01) | (-1.99) |
| Insider stock net sell | | | -2.52 |
| | | | (-1.20) |
| Prior return | -0.08 | 0.03 | 0.00 |
| | (-0.50) | (0.15) | (0.02) |
| Pre-month return | -0.16** | -0.12** | -0.13** |
| | (-2.60) | (-2.15) | (-2.24) |
| Size | -0.04 | 0.01 | 0.00 |
| | (-1.15) | (0.21) | (0.05) |
| B/M | 0.07 | 0.24 | 0.22 |
| | (0.30) | (1.00) | (0.92) |
| Turnover | -2.33* | -2.19* | -1.90 |
| | (-1.83) | (-1.72) | (-1.47) |
| Intercept | 0.09 | -0.09 | -0.09 |
| | (0.46) | (-0.48) | (-0.47) |
| N | 58 | 58 | 58 |
| R-squared | 0.2169 | 0.3150 | 0.3229 |

**Table 8: Simulations on Pseudo-bankruptcy Filings**

This table shows the simulation regression results on pseudo-bankruptcy filings. We use three methods in selecting the pseudo-events. Using method 1, for each bankruptcy firm, we randomly choose a non-filing date as the pseudo-filing date, from all days with options trading data for that firm. Using method 2, on each bankruptcy filing date in our sample, we randomly select a non-bankruptcy firm as the pseudo-firm. Using method 3, we randomly select a non-bankruptcy firm on a non-filing date as the pseudo-event from the pool of all firms with options trading data. After that, we calculate buy-and-hold abnormal return (BHAR) from day $t-1$ to $t$ as the pseudo-announcement return. For Panel A, we regress the BHAR on insider options trading, controlling for insider stock net sells, pre-month return, size, B/M, and turnover. For Panel B, we regress the BHAR on O/S computed from day $t-4$ to $t-3$, controlling for the factors used in Panel A. Variable definitions are in Table 1. For each regression, we run above process is repeated for 1,000 times. We then calculate the average coefficient and its $t$-statistics (in parenthesis). We also calculate the fraction of simulation coefficients that are higher than the simulation coefficient in the original "baseline" OLS regression (reported in brackets). In each case, we also report the original coefficient from the baseline regression. For the models in Panel A, the "original" coefficient is in Table 4 Column 4 and for Panel B it is in Table 5 Column 4.

| Panel A: Insider Options Trading | | | | |
| --- | --- | --- | --- | --- |
| | Original (Table 4, Column 4) | Method 1 | Method 2 | Method 3 |
| Insider Options Trading Coefficient | -18.67 | 0.03 | -0.01 | -0.00 |
| $t$-stat | (-2.98) | (1.07) | (-0.36) | (-0.11) |
| Proportion higher than original | | [0.00] | [0.00] | [0.00] |
| Panel B: O/S | | | | |
| | Original (Table 5, Column 4) | Method 1 | Method 2 | Method 3 |
| O/S Coefficient | -3.17 | -0.02 | -0.01 | -0.01 |
| $t$-stat | (-2.40) | (-2.93) | (-2.52) | (-2.52) |
| Proportion higher than original | | [0.00] | [0.00] | [0.00] |

# Table 9: Robustness Tests

This table contains OLS regression models that reflect various robustness tests. Model 1 focuses on the change in O/S from a pre-event benchmark period to the pre-filing period. Specifically, $\Delta O/S = O/S(t-4, t-2) - O/S(t-200, t-100)$, where $O/S(\tau_1, \tau_2)$ is the total options trading scaled by the total stock trading between day $\tau_1$ and day $\tau_2$. Model 2 uses the O/S on day $t-2$. Models 3-4 use the same O/S measure as in the main results (i.e. Table 5), but focus on different event-windows. Model 3 examines BHARs from day $t-1$ to day $t+1$, Model 4 from day $t$ to day $t+1$, Model 5 examines the abnormal return on day $t$. Model 6 contains a regression that controls from short interest, obtained from the Compustat short interest data. Table 1 contains the variable definitions. Parentheses contain White (1980) $t$-statistics and superscripts ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

| Dependent Variable | BHAR (-1,0) | BHAR (-1,0) | BHAR (-1,1) | BHAR (0,1) | AR (0) | BHAR (-1,0) |
|---|---|---|---|---|---|---|
| Model | 1 | 2 | 3 | 4 | 5 | 6 |
| O/S $(t-2)$ | | -3.13*** | | | | |
| | | (-3.19) | | | | |
| O/S $(t-4, t-2)$ | | | -4.33** | -6.45* | -4.39** | -3.93*** |
| | | | (-2.47) | (-1.94) | (-2.50) | (-2.86) |
| $\Delta$ O/S | -1.58* | | | | | |
| | (-1.82) | | | | | |
| Insider options trading | -17.27*** | -19.07*** | -13.71** | -12.15** | -19.93*** | -18.64*** |
| | (-2.84) | (-3.18) | (-2.25) | (-2.13) | (-3.82) | (-2.90) |
| Insider stock net sell | -2.20 | -1.58 | -1.07 | -0.65 | -0.66 | -3.54 |
| | (-1.15) | (-0.82) | (-0.36) | (-0.18) | (-0.35) | (-1.61) |
| Pre-month return | -0.18*** | -0.17** | -0.16** | -0.12 | -0.13** | -0.13** |
| | (-2.77) | (-2.47) | (-2.02) | (-1.41) | (-2.15) | (-2.23) |
| Size | -0.05 | -0.02 | 0.05 | 0.12 | 0.03 | 0.03 |
| | (-1.25) | (-0.49) | (0.85) | (1.29) | (0.56) | (0.85) |
| B/M | 0.04 | 0.13 | 0.20 | -0.14 | -0.06 | 0.20 |
| | (0.16) | (0.52) | (0.71) | (-0.28) | (-0.13) | (0.65) |
| Turnover | -2.15 | -1.64 | -0.88 | -0.85 | -2.11 | -0.05 |
| | (-1.67) | (-1.27) | (-0.57) | (-0.33) | (-1.08) | (-0.04) |
| Short Interest | | | | | | -1.99*** |
| | | | | | | (-4.76) |
| Intercept | 0.05 | -0.03 | -0.47 | -0.84 | -0.24 | -0.31 |
| | (0.22) | (-0.16) | (-1.38) | (-1.67) | (-0.89) | (-1.68) |
| N | 58 | 58 | 42 | 42 | 42 | 49 |
| R-squared | 0.229 | 0.242 | 0.157 | 0.240 | 0.280 | 0.346 |

## Table 10: Delistings and Filings

This table contains models that examine the relationship between O/S and returns around delistings and/or filings. Columns 1 and 2 analyze the O/S-return relationship for a sample of companies that CRSP records as delisting due to bankruptcy or liquidation (i.e. delisting codes 400-499 or 573). Here, the dependent variable is the BHAR from day $t-1$ to day $t$, where day $t$ is the day of delisting. Columns 3 and 4 combine this sample with the original bankruptcy filing sample. Here, if the company files for bankruptcy in the original sample, then we use the observations from the original sample. However, if the company is not in the original sample, and is recorded in CRSP as delisting due to liquidition or bankruptcy, then we include the O/S and return data from around that delisting. This increases the sample by 21 observations. In Columns 5 and 6 we combine both the delisting and the bankruptcy-filing sample. Here, we include the O/S and return data around both the filing and the delisting. Table 1 contains the variable definitions. Parentheses contain White (1980) $t$-statistics and superscripts ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

| Sample | CRSP delisting sample | | Filing or delisting | | Filing and delisting | |
| --- | --- | --- | --- | --- | --- | --- |
| Model | 1 | 2 | 3 | 4 | 5 | 6 |
| O/S | -4.31*** | -4.91*** | -4.20*** | -4.01*** | -3.81*** | -3.88*** |
| | (-3.26) | (-3.36) | (-3.71) | (-2.90) | (-4.48) | (-4.08) |
| Insider options trading | 0.08 | 1.16 | -17.97*** | -18.39*** | -13.84*** | -13.63*** |
| | (0.02) | (0.20) | (-3.63) | (-3.64) | (-3.00) | (-2.86) |
| Insider stock net sell | -0.58** | -0.80** | -1.96 | -1.80 | -0.78 | -0.82 |
| | (-2.17) | (-2.65) | (-1.18) | (-1.10) | (-1.54) | (-1.54) |
| Pre-month return | -0.15* | -0.11 | -0.18*** | -0.18*** | -0.16*** | -0.16*** |
| | (-1.72) | (-1.21) | (-3.44) | (-3.51) | (-3.51) | (-3.43) |
| Size | 0.03 | 0.03 | -0.02 | -0.02 | -0.00 | -0.01 |
| | (0.99) | (1.07) | (-0.56) | (-0.54) | (-0.22) | (-0.22) |
| B/M | 0.06 | 0.08 | 0.04 | 0.04 | 0.08 | 0.08 |
| | (0.58) | (0.65) | (0.33) | (0.26) | (0.70) | (0.70) |
| Turnover | | 1.08 | | -0.39 | | 0.16 |
| | | (1.58) | | (-0.38) | | (0.27) |
| Intercept | -0.32* | -0.35** | -0.08 | -0.06 | -0.15 | -0.16 |
| | (-1.99) | (-2.22) | (-0.52) | (-0.41) | (-1.31) | (-1.27) |
| N | 52 | 52 | 79 | 79 | 110 | 110 |
| R-Squared | 0.2307 | 0.2641 | 0.2317 | 0.2331 | 0.2186 | 0.2190 |

# Figures

## Figure 1: Average Daily Abnormal Return

These figures show the equal-weighted average daily abnormal return from day $t - 30$ to day $t + 1$, where day $t$ is the filing date, across our sample firms with options trading data (Figure 1(a)) and all bankruptcy firms (Figure 1(b)). CRSP value-weighted market return is used as benchmark in calculating abnormal returns.

### (a) Daily Abnormal Return for Sample Firms
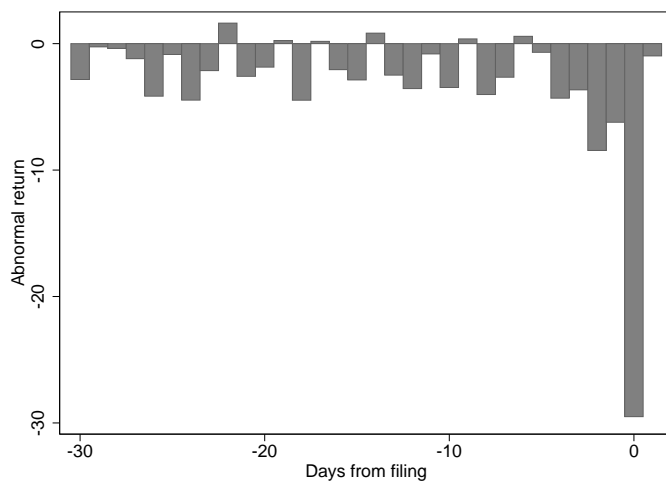

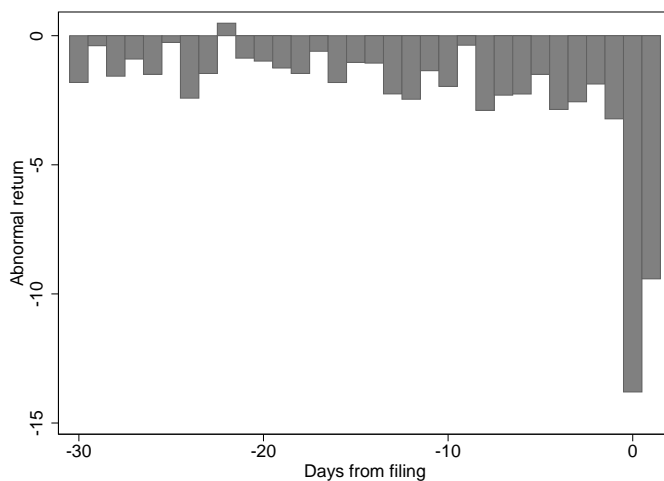
### (b) Daily Abnormal Return for All Bankruptcy Firms

**Figure 2: Average Buy-and-hold Abnormal Return**

This figure shows the equal-weighted average buy-and-hold abnormal return from day $t-30$ to day $t+1$, where day $t$ is the filing date, across our sample firms with options trading data (solid line) and all bankruptcy firms (dashed line). On each trading day, we calculate compounded return from day $t-30$ to that day as the buy-and-hold return. CRSP value-weighted market return is used as benchmark in calculating abnormal returns.
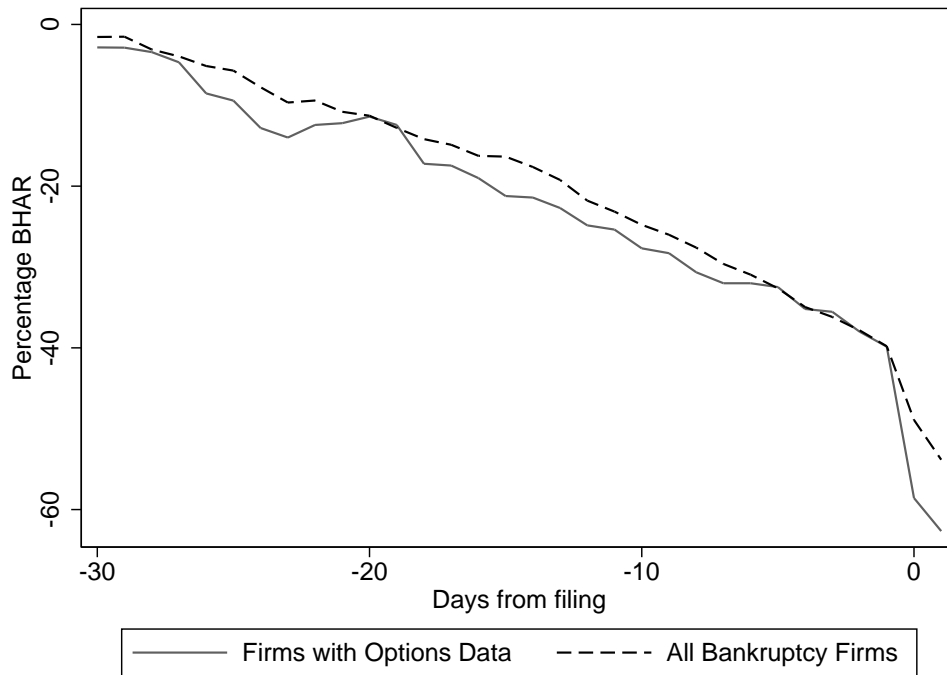
**Table A.1: A List of Bankruptcy Sample Firms**

This table lists all bankruptcy firms in our final sample. Bankruptcy data is obtained from UCLA-LoPucki Bankruptcy Research Database. The sample period is from January 1996 to December 2012. We first require the firm to have CRSP return data on day $t-1$ and day $t$, and accounting information from Compustat. We further require the firm to have options trading data from OptionMetrics before it files for bankruptcy. We show the filing date, firm name, and primary SIC code for the 58 firms in our final sample.

| Filing Date | Firm Name | Primary SIC |
|---|---|---|
| 6/25/1996 | Morrison Knudsen Corp. | 1540 |
| 12/27/1996 | Marvel Entertainment Group, Inc. | 2721 |
| 1/16/1998 | Pegasus Gold, Inc. | 1040 |
| 7/19/1998 | FPA Medical Management, Inc. | 8093 |
| 10/1/1998 | Southern Pacific Funding Corporation | 6159 |
| 10/5/1998 | Boston Chicken, Inc. | 5812 |
| 12/29/1999 | Fruit of the Loom, Inc. | 2250 |
| 1/7/2000 | Applied Magnetics Corporation | 3679 |
| 6/9/2000 | Safety Kleen Corp. | 4955 |
| 6/15/2000 | Flooring America, Inc. | 5700 |
| 12/6/2000 | Armstrong World Industries, Inc. | 3089 |
| 12/29/2000 | Pacific Gateway Exchange, Inc. | 4813 |
| 3/7/2001 | Finova Group, Inc. | 6153 |
| 4/2/2001 | W.R. Grace & Company | 2800 |
| 4/6/2001 | Pacific Gas & Electric Co. | 4931 |
| 4/18/2001 | Winstar Communications, Inc. | 4813 |
| 5/2/2001 | Viatel Inc. | 4813 |
| 6/25/2001 | USG Corp. (2001) | 3270 |
| 9/26/2001 | Exodus Communications, Inc. | 7389 |
| 9/28/2001 | At Home Corp | 7370 |
| 12/2/2001 | Enron Corp. | 6211 |
| 12/21/2001 | ACT Manufacturing, Inc. | 3672 |
| 4/1/2002 | Covanta Energy Corp. | 4991 |
| 9/12/2004 | US Airways Group, Inc. (2004) | 4512 |
| 9/22/2004 | Interstate Bakeries Corporation | 2050 |
| 1/11/2005 | Ultimate Electronics, Inc. | 5731 |
| 2/2/2005 | Tower Automotive, Inc. | 3460 |
| 8/6/2007 | American Home Mortgage Investment Corp. | 6798 |
| 11/8/2007 | InPhonic, Inc. | 4899 |
| 12/17/2007 | Delta Financial Corporation | 6163 |
| 4/10/2008 | Frontier Airlines Holdings, Inc. (2008) | 4512 |
| 8/4/2008 | WCI Communities, Inc. | 1531 |
| 9/15/2008 | Lehman Brothers Holdings Inc. | 6211 |
| 9/26/2008 | Washington Mutual, Inc. | 6035 |
| 10/17/2008 | WorldSpace, Inc. | 4832 |
| 11/10/2008 | Circuit City Stores, Inc. | 5731 |
| 11/26/2008 | LandAmerica Financial Group, Inc. | 6361 |

| | | |
|---|---|---|
| 1/14/2009 | Nortel Networks Corp. (Nortel Networks, Inc.) | 3661 |
| 5/17/2009 | TXCO Resources Inc. | 1311 |
| 10/1/2009 | Edge Petroleum Corporation | 1311 |
| 11/8/2009 | Advanta Corp. | 6141 |
| 11/15/2009 | Champion Enterprises, Inc. | 2451 |
| 8/25/2010 | Trico Marine Services, Inc. (2010) | 4400 |
| 11/8/2010 | Ambac Financial Group, Inc. | 6351 |
| 12/12/2010 | Great Atlantic & Pacific Tea Company, Inc. | 5411 |
| 2/16/2011 | Borders Group, Inc. | 5940 |
| 10/31/2011 | MF Global Holdings Ltd. | 6200 |
| 11/29/2011 | AMR Corporation | 4512 |
| 12/12/2011 | Lee Enterprises, Incorporated | 2711 |
| 1/4/2012 | Trident Microsystems, Inc. | 3674 |
| 1/19/2012 | Eastman Kodak Company | 3861 |
| 2/14/2012 | Energy Conversion Devices, Inc. | 3674 |
| 4/1/2012 | Pinnacle Airlines Corp. | 4512 |
| 7/9/2012 | Patriot Coal Corporation | 1220 |
| 8/17/2012 | ATP Oil & Gas Corporation | 1311 |
| 10/16/2012 | A123 Systems, Inc. | 3690 |
| 11/14/2012 | Overseas Shipholding Group, Inc. | 4412 |
| 12/19/2012 | THQ Inc. | 7372 |