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Institutional Ownership and the Resolution of Financial Distress

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Abstract

We analyze the distressed firm's decision between Chapter 11 and an exchange offer. We construct a comprehensive data set on the financial characteristics and capital structure of 269 distressed firms, which, unlike previous studies, uses quarterly information and includes exhaustive data on equity and bond ownership by institutional investors. Logit regressions confirm that the firm's restructuring decision depends on its financial characteristics as well as the equity and bond ownership of institutional investors. The impact of ownership varies across categories of investors and according to whether they hold equity or bonds. In general, equity ownership favours exchange offers while we find mixed evidence for bond ownership. In particular, hedge funds have a positive impact on the likelihood of exchange offers through their equity holdings but none through their bond holdings. Finally, the magnitude of equity and bond institutional ownership depends on the quarter at which they are measured, confirming the importance of using quarterly data.

Keywords: Out-of-court restructuring, exchange offer, Chapter 11, institutional investors

JEL classification: G21; G23; G33

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1. Introduction

For large firms with public debt, the onset of financial distress is often a signal of the need for debt restructuring either through a court-supervised procedure, such as Chapter 11, or an out-of-court procedure, such as an exchange offer. By and large, the owners and creditors of such firms share a common interest in avoiding the higher bankruptcy costs associated with Chapter 11. Yet, they may have conflicting interests in the best course to resolve financial distress. The combination of the upside risk from continuation on the one hand, and the elimination of equity in bankruptcy on the other, mean share holders prefer to avoid Chapter 11. By contrast, the downside risk from continuation and the protection of claims offered in bankruptcy mean bond holders prefer Chapter 11. Thus, the question of competing claims is essentially empirical and predicated on comprehensive data on bond and equity holdings at the distressed firms. Moreover, powerful institutional investors among the distressed firm's owners and creditors are also a source of competing interests: pension funds and hedge funds face different regulations, insurance companies and private equity may not share the same time horizon, mutual funds may have different objectives from banks, and so on. Accounting for these rival interests requires data on all institutional investors across distressed firms. The objective of our paper is to assess empirically how the choice between Chapter 11 and an exchange offer is related to the bond and equity holdings of institutional investors.

In recent years, a large body of empirical research has developed on Chapter 11 and exchange offers. The bulk of this literature tends to focus on the roles played by particular investors or creditors—such as banks (James, 1996; Demiroglu and James, 2015) or hedge funds (Jiang et al., 2012; Lim, 2015)—or on the impact of specific assets—such as bonds (Bratton and Levitin, 2017) or derivatives (Danis, 2016). In our thorough analysis of the literature, we have not uncovered a single empirical study on the choice between Chapter 11 and an exchange offer that simultaneously considers the effect of all bond and equity holdings across all types of institutional investors.

In this paper, we merge quarterly data on the bond and share holdings of 15 types of institutional investor (bank, brokerage, corporation, endowment, family trust, foundation, government, hedge fund, individual investor, insurance company, investment advisor, others, pension fund, sovereign fund, private equity firm) with quarterly financial and procedural data for 131 Chapter 11 firms and 138 exchange offer firms over the period 2000-2018. By providing a complete picture of firms undergoing both kinds of restructuring procedure as well as investor equity and bond holding data for each investor in each firm leading up to

restructuring, the assembled data should provide a less biased and more robust analysis of the restructuring decision. Moreover, using quarterly data enables bond and share investments to serve various purposes for different investors during the 12 months preceding a Chapter 11 bankruptcy filing or an exchange offer.[1]

Comparison of the Chapter 11 and exchange offer samples reveals a number of interesting features. Chapter 11 firms have significantly higher current liabilities and current portion of long-term debt but lower long term debt than exchange offer firms, suggesting that Chapter 11 firms face short-term debt challenges while exchange offer firms are more concerned about long-term debt restructuring. While financial aggregates deteriorate over the four quarters prior to restructuring for both samples, the decline is more rapid in Chapter 11 firms. Interestingly, there is little difference in the debt structure, including in bank debt, between the samples.

Exchange offer firms have more bondholders while Chapter 11 firms have a higher percentage of bonds in default. In both samples, the largest bond investors are investment advisors, hedge funds, insurance companies, and banks. Investment advisors, insurance companies, and banks have significantly higher holdings in exchange offer firms, while hedge funds have higher holdings in Chapter 11 firms. The largest equity investors are investment advisors, individuals (i.e., insiders, such as company executives), hedge funds, banks, corporations, and VC/PE funds. Investment advisors, banks, pension funds, and governments have significantly higher share holdings in exchange offer firms

We proceed to estimate a logit model of the firm's choice between an exchange offer and Chapter 11 with a particular focus on the impact of institutional investor bond and equity holdings across the four quarters leading up to reorganization. The main findings are as follows. First, the addition of equity and bond holdings variables result in a statistically-significant improvement in the fit of the model, endorsing the approach of considering all investor groups and asset types at once. Second, the impact of equity and bond holdings vary across the four quarters leading up to restructuring, validating our use of quarterly data. In contrast to the existing literature that uses annual data from the most recent financial statement, quarterly data reveals the ownership dynamics in a firm's restructuring process. We believe this to be the first documented evidence of dynamic ownership effects in the context of financial restruc-

[1] Collating and cleaning the bond data is by far the biggest challenge. As pointed out by Koijen and Yogo (2019) "bond holdings data are not easy to merge with the 13F data" since there is no structured bond database for 13F securities.

turing. Third, consistent with the common view that equity seeks to avoid higher costs and the elimination of shares (under absolute priority) in Chapter 11, we find that higher shareholdings in the quarter before restructuring are significantly associated with exchange offers. Also, consistent with the view that bond holders have conflicting preferences over restructuring, we find that across all quarters, higher bond ownership by corporations and investment advisors is associated with exchange offers, while higher bond ownership by VC/PE firms is associated with Chapter 11.

The ownership dynamics evident in the quarterly data reveal several differences between equity and bonds. For example, while equity holdings by governments and pension funds are positively associated with exchange offers across most quarters, holdings by hedge funds, individuals, investment advisors, and VC/PE firms are positively associated with exchange offers only at Q1, while holdings by banks, corporations, family trusts, and insurance companies, are negatively associated with exchange offers every quarter except Q1. By contrast, the relationship between bond holdings and restructuring is constant over time: bond holdings across all quarters are positively associated with exchange offers for every investor type except VC/PE firms.

In terms of specific investors, while hedge fund bond holdings are unrelated to the firm's choice, hedge fund equity holdings favour exchange offers. Thus, we find no evidence to support hedge funds using debt strategically to effect Chapter 11 (Jiang et al., 2012). Further, we find only weak support for the Demiroglu and James (2015) findings that higher levels of bank debt increase the likelihood of an exchange offer. Lastly, unlike (Chu et al. (2019)), we find that joint equity and bond ownership reduces the likelihood of an exchange offer.

Finally, a subset of financial variables have strong and consistent effects across all specifications, indicating independence from capital structure and ownership. Interestingly, we also find that debt structure, and bank debt in particular, is unrelated to the choice of restructuring mechanism.

The paper is structured as follows. Section 2 lists the some relevant testable hypotheses from the existing literature on restructuring. Section 3 describes assembly of the comprehensive restructuring data set. Section 4 describes the contents of the data set. Section 5 begins to unpack detail on financial characteristics, capital structure, bond and equity ownership, and procedural detail on the Chapter 11 and exchange offer firms. Because we are particularly interested in differences between the two groups, much of the analysis in section 5 is based on mean comparison and difference-in-difference tests. Section 6 contains a detailed discussion

of the results from the logit analysis of the impact of financial characteristics, debt structure, bond characteristics, equity, and bond ownership by institutional investors on the choice between Chapter 11 and exchange offer. Section 7 investigates robustness of the logit regressions by using the elastic net variable selection procedure.

2. Literature and testable hypotheses

The purpose of this section is to collate the many hypotheses that have emerged from the literature on restructuring. While we focus on testable hypotheses that relate to the impact of institutional investors on restructuring, the later regression analysis also includes relevant financial information shown to be important in previous studies.

Early studies on the determinants of a firm's choice between the two debt restructuring approaches (Gilson et al., 1990; Asquith et al., 1994; Franks and Torous, 1994; Chatterjee et al., 1996) take the position that equity holders, represented by the firm's management, and creditors share an interest in avoiding the higher bankruptcy costs associated with court-supervised reorganization (Haugen and Senbet, 1978, 1988; Roe, 1983; Jensen, 1989, 1991; White, 1989; Gilson et al., 1990; Betker, 1997; Fisher and Martel, 2005; Bris et al., 2006).[2]

Generally speaking, however, creditors and equity holders have conflicting interests in distressed firms.[3] On the one hand, the combination of limited liability and the presence of debt introduces convexity into the equity holders profit function. Because equity represents a call option on the firm's cash flow, equity holders favour continuation and risk-taking activities outside of bankruptcy. Moreover, the application of absolute priority (APR) in Chapter 11 often means that equity is eliminated. For equity holders, bankruptcy costs, risk-taking, and the APR combine in favour of an exchange offer. Thus, equity holders have a strong preference to avoid Chapter 11.

H1. *The probability of an exchange offer increases with the proportion of equity owned by individual investors.*

On the other hand, risk-taking by equity holders may reduce the recovery rate on creditor

[2] See also Brunner and Krahnen (2008) and Jostarndt and Sautner (2010) for Germany, Blazy et al. (2014) for France, Leyman and Schoors (2008) for Belgium and Mayr et al. (2020) for Austria.

[3] Exchange offers are prone to a number of impediments linked to the presence of asymmetric information between informed managers and less well informed creditors, heterogeneous beliefs among investors, and coordination problems, especially in the presence of a large number of creditors and the incentives to holdout (Haugen and Senbet, 1978; Baird, 1986; Jackson, 1986; Roe, 1987; Giammarino, 1989; Gertner and Scharfstein, 1991; Mooradian, 1994; Detragiache and Garella, 1996; Hege, 2003; Hege and Mella-Barral, 2019; Carapeto, 2005; François and Raviv, 2017). See Hotchkiss et al. (2008) for a survey of the impediments to workout arrangements.

claims, implying that creditors bear all the downside risk of continuation. The profit function for creditors is concave, reflecting risk aversion. Moreover, debt claims have priority in Chapter 11, especially if the claims are secured, and replaced by new securities (debt or equity). Overall, creditors may feel better protected under a court-supervised reorganization procedure like Chapter 11. For bond holders, the effects of bankruptcy costs, risk aversion, the protection offered in Chapter 11 are in conflict.

H2. *The probability of an exchange offer can decrease or increase with the proportion of bonds owned by individual investors.*

In the last 20 years or so, a consensus has emerged among legal scholars that Chapter 11 has fallen under secured creditor control driven in part by the rise in DIP financing provided by secured creditors (Skeel, 2003; Baird and Rasmussen, 2002, 2003, 2006; Harner, 2008b,a; Ayotte and Morrison, 2009; Li and Wang, 2016; Tabb, 2019). To the extent that secured creditors have gained an advantage over other stakeholders in Chapter 11, one would expect disadvantaged groups to pursue their interests outside of bankruptcy, which would suggest a higher incidence of exchange offers.

H3. *The probability of an exchange offer increases with the proportion of unsecured debt.*

More recently, attention has focused on the role of creditors, investors, or assets in the restructuring decision. Lim (2015) focuses on the role of activist hedge funds and finds that the involvement of hedge funds in restructuring increases the likelihood of an out-of-court restructuring or a prepack reorganization. Jiang et al. (2012) also focuses on how hedge funds, which are present in most of the Chapter 11 cases in their sample, may attempt to use Chapter 11 to increase their control. The hedge fund strategy is to acquire unsecured debt prior to reorganization in order to increase the likelihood that the plan is accepted and the newly-acquired debt is transformed into equity. Jiang et al. (2012) confirms earlier findings by Harner (2008a,b, 2011) on the development of the distressed debt market for firms in Chapter 11 and the strategies adopted by institutional investors to influence corporate decisions.[4] As reported by Harner (2008b), 66% of investors in distressed firms believe that distressed debt investment is used to influence board or management decisions. This suggests that hedge funds may behave differently depending on the type of securities they hold in a firm.

[4]This view is reflected in the mission statement of the American Bankruptcy Institute Commission to Study the Reform of Chapter 11 which states: "In light of the expansion of the use of secured credit, the growth of distressed-debt markets and other externalities that have affected the effectiveness of the current Bankruptcy Code, the Commission will study and propose reforms to Chapter 11 ...". See also Harner (2014).

H4a. *The probability of an exchange offer increases with the proportion of equity held by hedge funds.*

H4b. *The probability of an exchange offer decreases with the proportion of bonds held by hedge funds.*

Chu et al. (2019) examines the impact of simultaneous debt and equity holdings, concluding that simultaneous holdings of different types of securities (loans, bonds, and equity) increases the likelihood of out-of-court restructuring over Chapter 11. Yet, as we have seen earlier, while the equity position of institutional investors favours an exchange offer, the impact of the bond position is ambiguous. Thus, the impact of simultaneous holdings remains an empirical issue.

H5. *The probability of an exchange offer can decrease or increase with simultaneous equity and bond holdings.*

Demiroglu and James (2015) assesses the impact of bank lenders, syndicated loans, and CLOs on troubled debt restructurings. The paper finds that traditional bank loans are easier to restructure outside bankruptcy than institutional loans and that the likelihood of a prepack Chapter 11 procedure increases with CLOs.

H6. *The probability of an exchange offer increases with the proportion of bank debt.*

Finally, while an exchange offer can be structured to penalize holdout—e.g., by replacing existing bonds with more senior bonds having a shorter maturity or by eliminating important covenants—the outcome depends on satisfying a sufficient majority of bondholders. In practice (Bratton and Levitin, 2017), debtors typically impose a 90% minimum tender condition to reduce the impact of holdouts, paradoxically increasing the likelihood that the offer fails.[5] Yet, based on a more recent sample of bond workouts, Bratton and Levitin (2017) argues that workouts have become more flexible, suggesting that the attractiveness of exchange offers may have increased in the last decade.

H7. *The probability of an exchange offer is higher for the 2010-18 period than for the 2000-2009 period.*

[5]For empirical evidence, see: Brown (1989); Gilson et al. (1990); Franks and Torous (1989, 1994); Asquith et al. (1994); Chatterjee et al. (1995, 1996); James (1996); Betker (1997); Lie et al. (2001); Mooradian and Ryan (2005); Daniels and Ramirez (2007).

3. Sample

We construct the sample following the Demiroglu and James (2015) two-step procedure.[6] First, we identify a sample of U.S. firms in financial distress from the period January 1, 2000, to December 31, 2016, using recent stock price performance (CRSP), leverage, interest coverage ratio and size (Compustat).[7] We then focus on firms with average assets of at least $100m (2000, Q2 dollars) over the 3 years prior to distress.[8] Based on this procedure, we identify 840 distressed firms.[9]

Second, for each distressed firm, we search for evidence of an exchange offer or a Chapter 11 filing within a 2-year window either side of the date of financial distress.[10] We search in the LoPucki Bankruptcy Research Data (BRD) to identify firms which filed for Chapter 11. All types of Chapter 11 proceedings (prepacked, free fall, pre-negotiated, and §363 sales) are considered. To identify additional Chapter 11 cases, we also search BankruptcyData.com, Moody's Default and Recovery Database (MDRD), Fitch, and Standard & Poors. Finally, we conduct an extensive search of EDGAR 8-K filings and Capital IQ for distressed firms not already identified. Excluding 49 firms that filed for Chapter 11 outside the 2-year window, 69 firms in distress for consecutive years but with a single Chapter 11 procedure, and 27 firms with missing financial, equity, or bond holdings information, our final Chapter 11 sample includes 131 firms.

To identify out-of-court debt restructurings, we conduct a search in Factiva news stories for the terms 'exchange offer' and 'debt restructuring' during the 2-year window around financial distress. We restrict our sample to cases related to an actual (or anticipated) default, including: (1) reduced principal or interest payments on the debt, (2) accepted equity securities (or securities convertible into equity) for some or all of the outstanding debt claims, and (3) extended maturity of debt. We complement this procedure by searching EDGAR 8-K filings, MDRD, and by referring to the samples reported by Danis (2016) and Bratton and Levitin (2017).[11] Excluding 4 firms which filed for an exchange offer outside the 2-year window, 58 firms in distress for consecutive years but with a single exchange offer procedure, and 7 firms

[6] This approach is a variant of the methodology used in Gilson (1989) and Gilson et al. (1990).

[7] We calculate the three-year cumulative common stock return for all SIC codes, excluding utilities and financial firms and select firms in the bottom 5% of the CRSP universe for each calendar year over the sample period. Firms with a book leverage ratio below 30% and an interest coverage ratio (EBITDA/interest expense) greater than three are excluded as they are considered 'unlikely' to be financially distressed.

[8] Hu and Black (2008b) uses a lower cutoff of $50 million in book value of assets.

[9] Some firms appear more than once because they are in distress for more than one year. For example, Ambassadors International Inc., identified as in distress in 2008, 2009, and 2010, appears three times in the sample.

[10] Unlike Gilson et al. (1990), we consider exchange offers and Chapter 11 procedures irrespective of whether they succeed of fail.

[11] We would like to thank William Bratton and Adam Levitin for access to their sample.

with missing financial information, equity, or bond holding information, our final exchange offers sample includes 138 firms.[12]

Table 1 lists the number of Chapter 11 and exchange offer cases by year of filing and year of distress. There are clear peaks after the dot-com bubble and market crash of 2000, the 2008 financial crisis and the highly volatile stock markets of 2015 and 2016.[13] This is consistent with the distribution of cases reported by Demiroglu and James (2015) for the 1999-2011 period. At the quarterly level, negative market events seem to impact exchange offers more quickly than Chapter 11 filings. For instance, 7 of the 10 exchange offers in 2000 took place in the quarter immediately following the March 2000 stock market crash. By contrast, only one Chapter 11 case was filed in the same quarter; the bulk of the Chapter 11 cases occurred in the following three years. Similarly, we observe a significant increase in exchange offer filings during the 2008 financial crisis, while the increase in Chapter 11 filings is not until 2009. Unsurprisingly, the data reveal that, at the time of filing, all but one of the Chapter 11 firms were in distress, compared with 72% of the exchange offer firms. Distressed firms planning for bankruptcy have a strong incentive to 'buy time' before filing, whereas firms aiming to avoid bankruptcy are likely to pursue a rapid solution with creditors. Three industrial sectors—manufacturing; mining; transportation, communications, electric, gas and sanitary services—account for roughly three-quarters of the cases for both samples.[14]

4. Data

Broadly speaking, the data include three types of information: financial characteristics, equity holdings, and bond holdings. The data for each firm is recorded for each of the four quarters prior to filing for Chapter 11 or an exchange offer.[15] Our approach differs from most previous studies which typically use financial data from the most recent annual report prior to filing. In contrast to annual data, quarterly data allows us to capture some of the dynamics leading up to restructuring. We source financial variables from Compustat, detailed debt information from the Capital IQ *Capital Structure Summary*, equity data from the Capital

[12] In some cases, an exchange offer is followed by a Chapter 11 filing. These are considered to be separate events if the exchange offer was accepted by the creditors before the Chapter 11 filing. In our analysis below, these *dual* procedures are captured by a dummy variable equal to 1 if the time difference between the two procedures is less than 2 years. There are 35 dual procedures and the average time between the two procedures is 277 days.

[13] We split the sample into four periods: before 2008, 2008-09, 2010-14, and after 2014. There is no statistical difference between the proportion of Chapter 11 and exchange offers cases across the periods.

[14] This is higher than Chatterjee et al. (1996) who report a ratio of 50% and 62% for these sectors in Chapter 11 and exchange offers respectively.

[15] We ignore financial data from the filing quarter per se because it may include post-filing information.

IQ *Balance Sheet, Supplemental Items* and bond data from Bloomberg and Refinitive..

Equity ownership by institutional investors is relatively easy to collect since they are legally required to report their holdings. We collect detailed share holdings from the Capital IQ *Public Ownership* add-on. For each firm, we record the name of each shareholder, the number of common shares held, and owner type for each of the four quarters prior to filing.[16]

Bond ownership by institutional investors is more difficult to determine. Because bonds are not 13F securities, investors have no obligation to report their holdings. Fortunately, there are two sources for detailed historical bond holdings: Bloomberg and Refinitive (Eikon).[17] We search Bloomberg for all the bonds issued by each firm prior to filing. For each bond, we record the rank of the bond (e.g., senior, subordinated, etc.), the coupon rate, the maturity, the amount issued (which Bloomberg reports at face value in thousands of dollars), and whether the bond is in default at the time of filing. We also record the name of each bond holder, the holder's institutional type, and the number of bonds held in each of the four quarters prior to filing. We ignore bonds that lack detailed holding information in Bloomberg.

We use Refinitive to verify the bond information from Bloomberg, to determine the value of bonds outstanding in each of the four quarters prior to filing, and to identify bonds that are associated with the same offering but for different market segments. The last step is key to determining the exact number and value of bonds issued by each firm.[18] Table 2 displays a typical example of the bond holding data, in this case for a single bond (CUSIP 02076XAD4) issued by Alpha Natural Resources Inc., which filed for Chapter 11 on August 3, 2015. Jackson National Group, for example, is reported as holding 10,000 bonds every quarter, implying a bond position of $10,000,000 in each of the four quarters before Alpha's filing.

Matching data from several sources in this way requires strict attention to detail. Company names may change over time while names reported in Lopucki BRD, Capital IQ, Bloomberg and Factiva may differ. Investor names for bonds and equity present similar challenges. Thus, to arrive at an accurate, complete, and consistent list of investors for all firms, manual matching of company, share holder, and bond holder names was necessary. In some cases, holdings were reported at the fund level while in other cases reporting was at the group level. When feasible

[16]Equity ownership data is sourced from SEC 13Fs, 13Ds, 13Gs, Proxies, N30Ds and SEDAR filings.

[17]Bloomberg collects bond positions from a variety of sources including the Trade Reporting and Compliance Engine (TRACE) database maintained by the Financial Regulatory Authority (FINRA) that provides transaction information on the universe of U.S. corporate bonds. Broker-dealers have an obligation to report all transactions (within 15 minutes) to TRACE (Jankowitsch et al., 2014).

[18]For example, the same bond issued in the U.S. market, the European market (Eurobond), and the 144A market is treated as single bond rather than as three separate bonds.

(and correct), positions are merged; otherwise, holdings are reported separately. Because investor types vary between Capital IQ and Bloomberg, we create a standardized list of types, as shown in Table 3.

Finally, all bond and equity holdings data were cleaned and cross-checked for possible anomalies. For example, while most bond investors report positions quarterly, some seem to follow a different disclosure rhythm. Similar adjustments were made to the equity data in case of missing information, equity splits, or buybacks. Our pre-defined protocols for dealing with anomalies are detailed in Appendix 1.

The summary of the investor data in Table 4 shows that the sample contains 8,214 unique investors: 1,370 unique bond holders and 6,844 unique equity holders. There are 933 investors with simultaneous bond and equity positions in at least one of the four quarters prior to filing in Chapter 11 firms and 1,563 such investors in exchange offer firms. The vast majority of bond investors by number are insurance companies (47%), investment advisors (34%) and hedge funds (11%). For equity, the largest investor category is the individual/insider group (45%), which typically comprises the firm's top management, followed by investment advisors (31%), and hedge funds (11%).[19] In total, the sample includes 208,100 firm-bondholder-equityholder-quarterly observations—78,072 Chapter 11 observations and 130,028 exchange offer observations—covering the period January 1, 2000, to March 31, 2018.

5. Summary statistics

The purpose of this section is to provide an overview of the detailed firm- and investor-level information on financial characteristics, capital structure, ownership, debt, and restructuring procedure in our data.

5.1. Financial characteristics

Table 5 summarizes the firm-level financial information at Q1, the quarter prior to the restructuring event, as well as p-values for the mean and median differences between the Chapter 11 and exchange offer firms.[20] Given our sample selection procedure, firms in the sample are large, yet there are clear differences between the two groups: the mean assets for exchange offer firms ($2.5 billion) is roughly 80% higher than Chapter 11 firms ($1.4 billion), mean revenue ($352 million vs. $199 million) shows a similar pattern, while mean liabilities

[19] Government claims represent interests held by five U.S. state governments (California, Michigan, New York, Texas, and Wisconsin).

[20] Following Conroy (2012), we use quantile regression to test for the equality of medians rather than the (often wrongly-applied) Wilcoxon rank-sum (aka Mann-Whitney) test.

are 40% larger for exchange offer firms compared with Chapter 11 firms. These figures are consistent with Chatterjee et al. (1996) and Gilson et al. (1990) while Chu et al. (2019) finds the opposite. Interestingly, Demiroglu and James (2015) and Chu et al. (2019) find higher, not lower, revenue for Chapter 11 firms, which both interpret as reflecting an incentive for 'small' firms to restructure out-of-court to avoid large fixed bankruptcy costs. Notwithstanding our position that the restructuring decision depends on many factors besides bankruptcy costs, the samples in Demiroglu and James (2015), Chu et al. (2019), and our paper are limited to listed firms with assets and liabilities over $1 billion and sales over $100 million, which hardly qualify as 'small' firms.

Particularly striking in Table 5 are the much higher mean and median current liabilities and current portion of long-term debt at Chapter 11 firms. A similar pattern prevails for mean debt ratios relative to total liabilities: the current liabilities ratio is 65% for Chapter 11 cases versus 34% for exchange offers; the current portion of long term debt ratio is 42% for Chapter 11 firms and 11% for exchange offer firms. The median differences are even higher. The differences suggest that short-term debt repayment is a greater concern for Chapter 11 firms.

By contrast, both the level of long-term debt and its ratio to total liabilities are significantly higher for exchange offer firms ($1.3 billion and 54%) compared with Chapter 11 firms ($398 million and 25%). This is also the case for the ratio of long term debt to total assets (50% vs. 36%). Again, these are consistent with Chatterjee et al. (1996) and Gilson et al. (1990) but contrary to Chu et al. (2019). The differences suggest that exchange offer firms are focused on long-term debt issues.

Differences in asset composition between the two sets of firms are less pronounced than differences in liabilities. Exchange offer firms have higher current assets, cash and equivalent assets, and property, plant, and equipment than Chapter 11 firms. This is consistent with exchange offer firms having a lower liquidity shortfall and more fixed assets (PPE), a potential source of collateral. While the mean and median differences for the three variables relative to assets are not statistically significant, the assets to liabilities ratio is 132% for exchange offer firms and only 89% for Chapter 11 firms. In addition, Chapter 11 firms exhibit a significantly lower current ratio and a higher current liabilities to assets ratio than exchange offer firms, consistent with Gilson et al. (1990) and Franks and Torous (1994), and suggest greater overall financial difficulties for Chapter 11 firms.[21]

[21] PPE/Assets>100% in Table 6 because we use gross, rather than net, PPE.

More than 95% of firms restructuring under Chapter 11 and 75% of the exchange offer firms report negative net income, explaining the negative means for net income in both groups. Both groups show positive EBITDA and negative EBIT, on average, with exchange offer firms faring significantly better. The EBIT and EBITDA margins as well as the interest coverage ratio are negative and the differences are significant for median values.[22]

To highlight the dynamics in the firms' financial positions, Table 6 reports the first quarter (Q1) minus the fourth (Q4) quarter difference for the financial variables prior to the restructuring event (thus, negative values indicate a decrease). The two right-hand columns of the table also show the differences in the Q4 to Q1 change between the Chapter 11 and exchange offer firms (thus, the difference in differences).

On the assets side, all aggregates are decreasing in absolute value from Q4 to Q1. While there are few significant differences between the two samples, the falls in assets between Q4 and Q1 are statistically significant at the 5% level for the Chapter 11 sample. Interestingly, for both samples, cash, current assets, and PPE all are increasing as a percentage of assets. This suggests that the drop in total assets is mainly explained by a reduction in long term investment (i.e., marketable securities) between Q4 and Q1 as firms concentrate their resources on restructuring. On average, there is a significant reduction in the assets to liabilities ratio for both sets of firms though the decrease is significantly smaller for exchange offer firms.

On the liabilities side, Chapter 11 firms have lower total liabilities at Q1 compared to Q4 than exchange offer firms, although the difference is not significant. For Chapter 11 firms, the current portion of long term debt and current liabilities are significantly higher in Q1 while long term debt is significantly lower in Q1 (in levels and relative to total liabilities). There is no evidence of a similar dynamic at the exchange offer firms: there are no significant differences in the levels and only small differences in the ratios of the three measures of liabilities between Q4 and Q1. Overall, the significant differences in the changes to liabilities between the two groups of firms seem to be due to changes at Chapter 11 firms.

In contrast to the Q4 to Q1 changes and Chapter 11/exchange offer differences in balance sheets, Table 6 shows that the are few changes or differences between the two groups in income statements apart from an almost identical drop in total revenue.

[22]Chatterjee et al. (1996) reports a negative EBITDA margin for Chapter 11 firms and a positive margin for exchange offer firms.

5.2. Debt structure

Table 7 summarizes debt structure at the firms. As a general comment, the differences between Chapter 11 and exchange offer firms are much less evident for capital structure than for financial characteristics. For example, exchange offer firms report an average of almost $1.5 billion in total outstanding debt (68% of total liabilities), Chapter 11 firms average about $1.1 billion in outstanding debt (71% of total liabilities), and the difference between samples is not statistically significant. Nonetheless, outstanding debt relative to total assets is significantly higher for Chapter 11 than exchange offer firms. For Chapter 11 firms, outstanding debt exceeds 100% of the value of assets, on average, leaving little room for new collateral on future loans. Likewise, the ratio of secured debt to total assets is also significantly higher for Chapter 11 firms.

Differences in the types of debt between exchange offer firms and Chapter 11 firms (in levels or ratios) are essentially non-existent, except for bonds and notes and unsecured debt. Similar to Gilson et al. (1990), bonds and notes and bank debt represent the largest proportions of total debt. Yet, we find two major differences from their study. First, in our sample, bonds and notes are at least two to three times larger (in value and in proportion) than bank debt; Gilson et al. (1990) report the reverse. Second, the ratio of bonds and notes to debt outstanding in our sample is significantly larger than Gilson et al. (1990) where public debt accounts for 8% and 13% of total liabilities for Chapter 11 and exchange offer firms, respectively. Our results are more aligned with those of Asquith et al. (1994) where public debt represents 52% of the total debt of financially distressed firms.

For both groups, 85% of debt is senior, 54-60% is unsecured, and 21% is convertible.[23] Finally, the debt structure of all firms is relatively stable over the year prior to filing, with the exception of Chapter 11 firms, which exhibit significant changes in bank, secured, and unsecured debt as well as in bonds and notes.[24]

5.3. Bond and equity ownership

Table 8 reports the number of Chapter 11 and exchange offer firms with positive bond and equity holdings reported by investor type for the four quarters prior to filing.[25] At Q1, 74% (97/131) of Chapter 11 firms and 72% (100/138) of exchange offer firms have bonds reported

[23]The ratios are similar to those reported by Demiroglu and James (2015), although their ratios are relative to total liabilities.

[24]Not shown in tables.

[25]In total, there are 277 unique bonds issued by Chapter 11 firms and 343 unique bonds issued by exchange offer firms.

in Bloomberg.[26] For both groups, the top 4 bond investor types are investment advisors, insurance companies, banks, and hedge funds. The picture is slightly different for equity holdings. Investment advisors are present in almost all restructuring procedures, closely followed by individual investors (mostly comprising top management), banks, hedge funds, pension funds, family offices, and insurance companies. Not surprisingly, bond holdings are more concentrated among fewer investor types. Similar to Jiang et al. (2012), we find that hedge funds have a strong presence on both the debt side and equity side of restructuring firms.

Table 9 contains detailed bond information for Q1, the quarter prior to filing. Compared to Chapter 11 firms, exchange offer firms report a higher total value of bonds issued and outstanding.[27] However, there is no significant difference in the number of bonds issued, the amount issued per bond, or the amount outstanding per bond.[28]

Exchange offer firms have more bondholders (72 vs. 44), resulting in a significantly lower amount per bondholder issued ($21 million vs. $28 million) and outstanding ($17 million vs. $23 million). Exchange offer firms also have a higher total value of bond holdings reported by investors ($502 million vs. $278 million) than Chapter 11 firms.[29] Not surprisingly, the proportion of bonds in default is significantly higher for Chapter 11 (88%) than for exchange offer (11%) firms. Demiroglu and James (2015) report a similar default rate for Chapter 11 but a much higher (63%) default rate for out-of-court restructuring, probably due to the fact that they consider loans while we focus on bonds. There is no apparent difference in the distribution of bond classes between the two procedures. Senior unsecured bonds represent more than two-thirds of all bonds reported for both Chapter 11 and exchange offer firms, followed by senior subordinated.[30] Finally, there is no statistical difference in the number of shares outstanding between Chapter 11 and exchange offer firms although the total number of shares reported by investors is significantly higher for exchange offers (55 million) compared with Chapter 11 firms (30 million).

One of the key features of our data is the detailed information on bond and equity holdings by investor type in each of the four quarters leading up to the restructuring event. Bloomberg reports the total dollar value of bonds issued by each firm. The number of bond units held by each investor in each of the four quarters prior to filing is multiplied by 1,000 (the nominal

[26] Chatterjee et al. (1996) finds that 38.8% of Chapter 11 firms, 58.8% of prepacks, and 100% of public workouts have public (rated) debt.

[27] Chapter 11 and exchange offer firms have a similar ratio of bonds outstanding to bonds issued (87% vs. 88%).

[28] The average number of bonds issued per firm is consistent with Asquith et al. (1994).

[29] The difference is also significant when expressed as a percentage of bonds outstanding. See Table 10.

[30] Not shown in tables.

value of a bond unit) to determine the total dollar position of each investor. For each quarter, we aggregate the bond positions by investor type across all the bonds issued by the firm and divide the aggregate bond holdings of each investor type by the total value of bonds outstanding for each quarter. Thus, for each firm we have a measure of the proportion of the total value of outstanding bonds held by each investor type in each quarter. Similarly, we construct a measure of the proportion of equity held by each investor type by dividing the number of shares held by each type by the total number of outstanding shares in the firm.

Table 10 reports bond holdings by investor type for the four quarters prior to filing. At Q1, total investor-reported bond holdings represent, respectively, 30.23% and 40.77% of the total value of bonds outstanding for Chapter 11 and exchange offer firms. While these numbers may appear low at first sight, they consistent with other sources. First, bonds reported in Bloomberg and Refinitive are essentially for institutional investor holdings in U.S. domestic and 144A bonds. Although it is possible to identify Eurobonds, in practice few have detailed holding information and are dismissed from our data. According to market data provider Statista, non-U.S. investors and households held about 28% and 12%, respectively, of U.S. corporate bonds in 2017,[31] figures confirmed by more recent data from the U.S. Federal Reserve System.[32] Excluding these two segments of the bond market leaves a potential bond market of 60% of bond ownership for U.S. corporations. Bonds reported in our study represent 30% to 43% of bonds outstanding (depending on quarter), or 50% to 72% of all bonds outstanding over the four quarters prior to restructuring.[33]

At Q1, investment advisors (14.1%) hold the largest proportion of bonds issued by Chapter 11 firms, followed by hedge funds (9.2%), insurance companies (4.1%), and banks (2.7%).[34] For exchange offer firms at Q1, investment advisors hold 22.7% of the outstanding bonds, followed by insurance companies (8.3%), hedge funds (5.2%) and banks (4.6%). Thus, these four investor types account for almost all of the outstanding bond holdings for both Chapter 11 and exchange offer firms. Also at Q1, the largest five individual bondholders hold 18%

[31] https://www.statista.com/statistics/1083823/ownership-us-corporate-bonds/

[32] https://www.marketwatch.com/story/who-owns-the-biggest-slice-of-the-15-5-trillion-corporate-bond-market-not-investors-in-the-u-s-11647544015

[33] The missing bonds are most likely due to investors that: i) have no obligation to report bond positions, ii) are hiding their holdings from competitors to gain an advantage prior to debt restructuring (e.g., hoping to influence or profit from the process by transforming their debt into equity [Jiang et al. (2012), Harner (2008a,b)]), and iii) consider reporting bond holdings to be a waste of time and effort, especially at Q1.

[34] While Koijen and Yogo (2022) report that insurance companies hold 38% of all U.S. corporate bonds, the vast majority of their holdings are NAIC 1-2 (low risk) bonds. NAIC 3-6 (high risk) bonds represent less than 10% of insurance company holdings, in the same range as our results given the focus on distressed firms.

of the outstanding bonds in Chapter 11 firms and 21% in exchange offer firms.[35] Clearly, bond holdings are concentrated in the hands of a small number of investors.

Bond holdings for investment advisors, insurance companies, banks, corporations, and hedge funds are significantly different between Chapter 11 and exchange offer firms in at least one of the four quarters before filing. Holdings in Q1 are significantly higher for hedge funds for Chapter 11 firms and significantly higher for exchange offers firms for banks, insurance companies, and investment advisors. This is consistent with the Jiang et al. (2012) view that hedge funds are active in the distressed debt market, seeking out opportunities where debt may be converted into new equity in order to gain control of the restructured firm.

Equity holdings display a different pattern to bond holdings: total reported holdings are higher, ownership is less concentrated among investor types, and the list of investor types with the largest holdings is different. Table 11 shows, at Q1, that exchange offer investors report a significantly higher proportion (66% vs. 45%) of total share holdings than Chapter 11 investors. The same pattern holds for the other three quarters, although the differences are not as large. This is consistent with Koijen and Yogo (2019) who report that 13F institutions in the U.S. collectively manage 68% of the stock market, the rest being managed by households.[36] Compared with bonds, higher reported share ownership most likely reflects the fact that reporting equity holdings is compulsory for institutional investors; reporting bond holdings is voluntary.

For both groups of firms, the largest (six) shareholders are investment advisors, individual investors, hedge funds, banks, corporations, and VC/PE firms. Share ownership by investment advisors and pension funds is significantly larger for exchange offers than for Chapter 11 firms for all four quarters before filing, while banks and governments have higher ownership for three quarters before filing, and hedge funds in the last quarter before filing.

Individual investors that simultaneously hold bonds and equity may influence the restructuring decision by mitigating shareholder-creditor conflicts.[37] At Q1, the proportion of outstanding *bonds* held by *equity* investors is 11.2% for Chapter 11 and 16.5% for exchange offers, a significant difference at the 5% level. At Q1, the proportion of outstanding *shares* held by *bond* investors is 5.2% for Chapter 11 and 10.5% for exchange offers, a significant difference

[35] These proportions are stable across the four quarters prior to restructuring.

[36] In the majority of Chapter 11 cases, equity is wiped out due to strict application of the absolute priority rule. Knowing their equity will be erased reduces the incentive for investors to report positions, which may explain the large difference in equity holdings between Chapter 11 and exchange offers, especially at Q1.

[37] Chu et al. (2019)

at the 1% level.[38] Thus, by either measure, investors with simultaneous bond-equity holdings are strongly associated with exchange offers.

5.4. Restructuring procedures

The majority of Chapter 11 cases are free fall (56.5%), followed by pre-negotiated plans (28.2%) and prepack plans (15.3%),[39] similar to Demiroglu and James (2015) (64% free fall; 36% prepack).[40] In our sample, over 82% of the Chapter 11 cases have a creditors' committee, 56% involve debtor in possession (DIP) financing, and 52% involved some asset sales.[41] A detailed textual analysis of the cases reveals that roughly 20% of the Chapter 11 cases report some deviation from absolute priority.[42] Close to 70% of the firms in the sample emerge successfully from Chapter 11, spending an average of 309 days in bankruptcy before emerging. Firms restructuring under an exchange offer report a success rate of 81% with an average of 88 days for creditor approval.[43] Finally, 26% of firms in Chapter 11 proposed an exchange offer in the two years prior to filing for Chapter 11.

6. Econometric analysis

While the univariate results provide useful background, they are clearly no substitute for multivariate analysis. In this section, we consider a logit model of the firm's restructuring decision. The dependent variable is 1 if a firm restructures its debt through an out-of-court exchange offer and 0 if it opts for a court-supervised Chapter 11 procedure. We build the regression specification in four steps. Following the empirical bankruptcy literature, we first consider financial variables and a set of dummy variables for the 2008–09 financial crisis.[44] Second, we add measures of types of debt (e.g., bonds and notes, bank debt, secured debt). Third, we add reported share holdings by investor type (e.g., banks, investment advisors, hedge funds, etc.). Fourth, we add reported bond holdings by investor type.

[38] These proportions are larger than those reported in Chu et al. (2019), likely because they consider only firms with four consecutive quarters of simultaneous bond-equity holdings before filing whereas we consider simultaneous holdings only for the quarter prior to filing.

[39] Not shown in tables.

[40] Free fall plans are traditional Chapter 11 procedures. A pre-negotiated plan is an agreement between the debtor and a key group of creditors without any solicitation of votes prior to bankruptcy filing. A prepack plan is an agreement between the debtor and creditors with solicitation of votes prior to bankruptcy filing.

[41] Source: Capital IQ *Transactions/Bankruptcies*, Lopucki BRD and Edgar.

[42] APR violations occur when junior security holders receive compensation before the claims of senior creditors have been fully reimbursed. We do not examine APR violations among different classes of creditors.

[43] Unlike Gilson et al. (1990), which defines a private debt restructuring plan to be successful if the firm does not file for bankruptcy within a year of the restructuring, we define success to be when the proposed exchange offer is accepted by creditors and implemented.

[44] A pre-crisis dummy is equal to 1 if the year of filing is before 2008, a crisis dummy is equal to 1 if the year of filing is 2008 or 2009, and a post-crisis dummy is equal to 1 if the year of filing is between 2010 and 2014.

The empirical literature on restructuring is usually based on data from the firm's most recent annual report to shareholders. Given that firms may file annual reports at any time of the year, the usual approach uses information that may vary from a few weeks to as much as one year before restructuring. To address this lack of consistency, we standardize across firms the time at which all variables are measured. Initially, we measure all variables at Q1, the quarter prior to filing. We proceed to investigate the impact of changing the quarter bond and share holdings are measured.

6.1. Logit results

Table 12 reports the logit results following the above four-step procedure with all variables measured at Q1. For the base model in the first column, the probability of an exchange offer is positively related to the firm's financial health, measured by the assets to liabilities ratio and the interest coverage ratio, and negatively associated with the ratio of current portion of long term debt to total liabilities and the EBIT margin. The firm's restructuring decision is not related to size measured by total assets and the presence of tangible assets in the balance sheet measured by the proportion of property, plant and equipment in total assets.[45] The financial crisis dummy variables are not statistically significant either.

In the second column of Table 12, we add the debt measures (outstanding, bonds and notes, senior, bank, and unsecured debt). None of the debt variables are statistically significant,[46] which explains why the pseudo-R^2 increases only marginally and the marginal effects of the financial variables are very similar to the base model. In the third column of Table 12, we add Q1 share holdings for the 10 investor types, share concentration among the 5 largest equity investors at the firm, and, to control for simultaneous holdings, the proportion of shares held by bondholders at the firm.[47] The pseudo-R^2 increases by almost 40% from the previous column, indicating that equity ownership is a useful addition to the model. Otherwise, the marginal effects for the financial and debt variables are very similar to the two earlier models. Adding the equity variables does not change the apparent irrelevance of debt structure for the restructuring decision.

In the last column of Table 12, we add Q1 bond holdings for the 6 investor types, the

[45] Alternative size measures such as total liabilities and revenues are also not significant.

[46] To be certain, we ran four logit regressions (one for each of the four quarters prior to the event) on the debt variables alone. The marginal effects for the debt variables are very weak, rarely significant, and become even weaker when the financial variables are added to the regressions.

[47] We do not include equity ownership measures for investor types with fewer than 15 observations of holdings (brokerages, endowments, foundations, sovereign funds, and 'others').

proportion of bonds held by equity holders, bond concentration among the 5 largest bond holders, the number of bonds issued by the firm, the total number of bond holders, the number of subordinated bonds,[48] and the number of secured bonds issued by the firm.[49] The pseudo-R^2 increases by 15% from the previous column, indicating that bond ownership contributes to the fit of the logit. The equity estimates are largely unchanged from the third column: governments, hedge funds, pension funds, and VC/PE funds share holdings remain strongly positively related to exchange offers. For the newly added bond variables, holdings by corporations and insurance companies are positively related and the proportion of bonds held by equity investors are negatively related to exchange offers. The probability of an exchange offer also increases with the number of subordinated bonds and decreases with the number of bonds issued.

Starting from the model in the last column of Table 12, we investigate the impact of using financial and debt information from one, two, three, and four quarters before restructuring. We find that Q1 financial and debt information produces pseudo R^2 values that are 30-70% higher than any of the other quarters. Thus, we settle on the use of Q1 financial and debt information for the remainder of the paper. Yet, it is an open question as to which quarterly measure of equity and bond holdings provide the best fit. Investors presumably adjust their holdings continually leading up to restructuring as new information comes to light and they weigh the likelihood of Chapter 11 versus an exchange offer against their own interests. Given our primary focus on institutional ownership, we investigate the impact of equity and bond holdings measured at Q1, Q2, Q3, and Q4.

6.2. Institutional ownership effects with matching quarterly observations

Table 13 reports the regression results when the equity and bond ownership variables are measured in the same quarter before restructuring. As such, column 1 replicates the last column (equity Q1, bond Q1) of Table 12. The pseudo-R^2 are roughly the same across the four models, indicating that both forms of ownership are associated with restructuring up to 12 months preceding restructuring. Four of the financial variables (measured at Q1) are strongly significant irrespective of the quarter at which equity and bond ownership is measured, suggesting that their role is independent from equity and bond ownership. Among the

[48] The number of subordinated bonds is the sum of subordinated and senior subordinated bonds

[49] We do not include bond ownership measures for investor types with fewer than 15 observations of holdings (brokerages, endowments, family trusts, foundations, governments, individual investors, pension funds, sovereign funds, and 'others').

debt variables, only debt outstanding/liabilities and bonds and notes/debt outstanding are significant.

In terms of institutional investors, the impact of equity ownership varies depending on the quarter of observation. The percentage of shares owned by governments and pension funds are positively and significantly related to the likelihood of an exchange offer in at least three of the four quarters prior to filing. By contrast, share holdings by banks, corporations, and insurance companies are negatively related to exchange offers significantly in one to three of the quarters prior to filing. There is also a significant and positive relationship between exchange offers and equity ownership by hedge funds, individuals, and investment advisors that appears only at Q1. For bond ownership, exchange offers are significantly positively associated with the percentage of bonds held by corporations and investment advisors for at least three of the four quarters prior to restructuring. Bond holdings by VC/PE funds, however, are significantly negatively related to exchange offers for all quarters except Q1.

Two measures capture the effect of simultaneous holdings by institutional investors: the percentage of shares held by bondholders and the percentage of bonds held by shareholders. In Table 13, the percentage of shares (bonds) held by bond investors (equity investors) is significantly negatively associated with the probability of an exchange offer at Q3 and Q4 (Q1 and Q2) but not at Q1 and Q2 (Q3 and Q4). Thus, for investors that hold equity and bonds simultaneously, the bond ownership effect dominates at Q1 and Q2 while the equity ownership effect dominates at Q3 and Q4. Either way, it is clear that joint bond and equity ownership in a firm is associated with Chapter 11.

For the bond variables, exchange offers are negatively associated with the number of bonds issued by a firm and positively associated with the number of subordinate bonds. Neither secured bonds nor the number of bondholders have an association with the firm's restructuring decision. Finally, the concentration of bond holdings among the top 5 shareholders also has little impact on the likelihood of an exchange offer while there is no evidence of any impact related to the 2008–09 financial crisis.

6.3. Institutional ownership effects in detail

While the matching quarter results are informative, there is no reason to presume that the quarters at which equity and bond holdings impact restructuring will be the same. Investors able to anticipate financial distress may adjust their positions at any time, either to protect themselves or to benefit from it.

Moreover, because the equity market is more active than the bond market and shares are

more liquid than bonds, adjustments in equity and bond ownership may systematically differ as restructuring approaches. There are $4 \times 4 = 16$ combinations of the 4 quarterly equity measures and 4 quarterly bond measures. Thus, varying the quarter of observation for equity holdings and bond holdings variables each from Q1 to Q4, we estimate 16 logit regressions in all.[50] We focus on the marginal effects of equity and bond holdings by investor types across the 16 logit regressions.

Table 14 shows the 10 equity holder type marginal effects grouped by the quarter of equity observation. Table 15 shows the 6 bond holder type marginal effects grouped by the quarter of bond observation. The last four rows of the tables also summarize the counts of the signs and statistical significance of the marginal effects across investor types.

Table 14 reveals that the relationship between equity holdings and exchange offers by investor type falls into one of three groups. Equity holdings by governments and pension funds are significantly positively associated with exchange offers across most of the 4 equity quarters. Equity holdings by hedge funds, individuals, investment advisors, and VC/PE firms are significantly positively associated with exchange offers at Q1, while in the other three quarters the effects are weak and may be positive or negative. Finally, equity holdings by banks, corporations, family trusts, and insurance companies, are only weakly related to exchange offers at Q1, yet are negatively associated with exchange offers for Q2-Q4, with the majority of the effects being statistically significant.

Table 15 shows that the timing and direction of the association between investor type bond holdings and exchange offers also falls into three groups. Bond holdings by corporations and investment advisors are significantly positively associated with exchange offers across the 4 bond quarters. Bond holdings by banks and insurance companies (plus hedge funds to a lesser extent) are significantly positively associated with exchange offers at Q1, while in the other three quarters the effects are weak. Finally, bond holdings by VC/PE firms are only weakly related to exchange offers at Q1, yet are significantly negatively associated with exchange offers for Q2-Q4.

Why both equity and bond marginal effects across the four quarters should break into these three groups is not immediately obvious. From the perspective of equity ownership, government share holdings are strongly related to exchange offers, consistent with the default 'job saving' position for governments as well as with the political considerations that arise from

[50] Of course, the marginal effects from 4 of these logits have already been reported in Table 13.

equity ownership in the first place. Corporations may be involved in restructuring through subsidiaries or related entities and have a strategic interest in preserving key inputs or expertise. Given their fiduciary duties, pension funds are clearly better off with an exchange offer to avoid the risk of being wiped out in Chapter 11. The same holds for hedge funds, VC/PE firms and individuals. From the perspective of bond ownership, banks and insurance companies are negatively impacted by a Chapter 11 procedure due to its implications for risk-adjusted capital ratios. Investment advisors holding bonds may have little appetite for Chapter 11 since debt is likely to be replaced by equity while the low bond holdings of pension funds are unlikely to have any impact. Lastly, VC/PE firms are unique in that higher equity holdings at Q1 are associated with exchange offers while higher bond holdings at Q2-Q4 are associated with Chapter 11. The contrasting effects of equity and bond holdings for VC/PE firms are uniform, without exception, across all 16 equity and bond quarters. It remains an open question as to why VC/PE holdings exhibit these effects.

Aside from the pattern of effects across individual investor types, it is interesting to consider aggregate trends across all investor types over the 16 logit regressions. For equity Q1-bond Q1 in Table 14 (column 1), 2 of the marginal effects are negative (family trusts, insurance companies), neither of which are significant at the 10% level, and 8 of the marginal effects are positive, of which 6 are significant. These counts are displayed in the last 4 rows of Table 14. The sign pattern of the equity ownership marginal effects changes systematically across equity quarter: the number of positive associations between equity and exchange offers rises from 3 at equity Q4, to 6 at equity Q3, to 5-6 at equity Q2, and 8-9 at equity Q1. Thus, the 'consensus' association between share holdings and exchange offers changes from negative at Q4 to positive at Q1. In terms of statistical significance, 6-7 of the effects at equity Q1 (depending on the bond quarter) are significant at the 10% level, indicating strong positive links between equity ownership and exchange offers just before restructuring.

Table 15 shows the sign pattern of the bond ownership marginal effects across bond-equity quarter combinations. For example, in the bond Q1-equity Q1 combination (column 1), 1 of the bond marginal effects is negative (VC/PE firms) and not significant, and 5 of the marginal effects are positive, of which 2 (corporations, insurance companies) are significant. These counts are displayed in the last 4 rows of Table 15. The sign pattern is the same for all but one of the 16 bond-equity quarter combinations: 1 negative (VC/PE firms) and 5 positive marginal effects. Thus, unlike for equity, the 'consensus' bond position is unchanged across quarters: bond holdings by all but one investor type are positively associated with exchange offers; the

outlier is bond holdings by VC/PE firms, which are always negatively associated with exchange offers. With the exception of Q1, all of the VC/PE effects are significant, while roughly half of the effects for the other 5 investor types are significant.

One feature that Table 14 and Table 15 have in common is that the sign counts for a given equity (bonds) quarter are the same across bonds (equity) quarters. For example, for equity Q3 in Table 14, there are 4 negative and 6 positive marginal effects regardless of the bond quarter. The sign counts are also the same for equity Q2 and bond Q2-Q3-Q4 (4 negatives, 6 positives), and equity Q1 and bond Q2-Q3-Q4 (1 negative, 9 positives). Thus, the effect of equity ownership is robust to changes in the quarter of observation for bond holdings. Similarly for bond Q3 in Table 15, there is 1 negative and 5 positive marginal effects regardless of the equity quarter. This sign pattern is evident for every other equity-bond quarter combination except bond Q4-equity Q1. Overall, Tables 14 and 15 indicate that the marginal effects for one ownership measure are robust to changes in the quarter of the other ownership measure.

6.4. Hypotheses

In view of our empirical findings, we reconsider the testable hypotheses in section 2 on the effect of institutional investors on a firm's restructuring decision.

At equity Q1, firms with higher equity holdings for 8 of the 10 institutional investor types are associated with an exchange offer, consistent with H1, and 6 of these are significant. Bond relationships at bonds Q1 are similar but slightly weaker: higher bond holdings for 5 of the 6 institutional investor types are associated with an exchange offer and 2-4 of these are significant depending on the equity quarter. Nonetheless, bond holdings by VC/PE firms are consistently negatively related to exchange offers for Q2-Q4. This exception provides partial support for the H2 notion that bond holders may have conflicting preferences over a firm's restructuring decision.

The finding that the probability of an exchange offer increases with the number of subordinated (unsecured) bonds supports H3 that exchange offers are more likely in firms with a higher proportion of unsecured debt. Moreover, none of the specifications find that secured debt or secured bonds have any association with the firm's decision.

The H4 relates to the impact of hedge funds on restructuring. The Table 14 results for Q1 support H4a that the likelihood of an exchange offer increases with the percentage of shares held by hedge funds, echoing the finding of Lim (2015). Yet, we find only a weak relationship for hedge fund bond holdings, and it is positive, so our evidence on H4b is weakly contrary to Jiang et al. (2012).

In general, debt and equity investors have conflicting interests in distressed firms. Chu et al. (2019) argue that simultaneous holdings of debt and equity in the same firm mitigate the conflict and find that simultaneous holdings increase the probability of an out-of-court restructuring. Using two different measures of simultaneous holdings of bonds and equity, we find precisely the opposite. The effect in Table 13 of simultaneous holdings is dominated by the percentage of shares held by bond holders at Q3 and Q4 and by the percentage of bonds held by equity investors at Q1 and Q2. Thus, although it is driven by different forces as restructuring approaches, the effect of simultaneous equity and bond holdings is consistently to favour Chapter 11, so we reject H5.

We find only weak support for H6 on the the positive impact of bank debt on the likelihood of an exchange offer. The proportion of bank debt in the firm's capital structure is not significant in any of the 6 best-fitting models while bond holdings by banks are significant at the 10% level for only one model. Our results, therefore, provide only muted confirmation of the Demiroglu and James (2015) findings.

The common view (Demiroglu and James, 2015; Chu et al., 2019) that the probability of an exchange offer decreases with the complexity of the restructuring can, in principle, be captured by variables such as firm size, the number of debt claimants, the number, and different types, of bonds issued by the firm. We find mixed evidence for the complexity effect. On the one hand, we do not find an effect of size and the number of bondholders on the likelihood of an exchange offer, and on the other hand, we do find that firms with a larger number of bonds are more likely to opt for Chapter 11.

Finally, we reject H7 as exchange offers are not more likely to be selected by firms in financial distress in the most recent period .

7. Robustness and variable selection

The vast amount of firm and investor information in our data set poses three related challenges to the logit analysis: selection of covariates, the possibility of overfitting, and multicollinearity. Because the number of potential covariates in the data set is greater than the number of observations, it is possible to predict perfectly a firm's decision between Chapter 11 and exchange offer. Clearly, we would learn nothing from such an approach. Given the danger of overfitting, a critical question is how to select (or screen) covariates. Related to selection is the possibility that multicollinearity may compromise the accuracy of the estimated marginal effects. For example, the debt variables in the logit regressions may be collinear with the bond

holdings variables. Attempts to reduce multicollinearity by eliminating covariates are fraught by the subjective order of elimination. While the debt variables are candidates for removal, given their lack of significance, the same could be said of the financial variables that are not significant. Eliminating variables is also open to 'selective inference' and related doubts about model robustness. To address these concerns, we supplement the logit regressions with elastic net (Zou and Hastie, 2005), which enforces sparsity in variable selection, potentially reducing multicollinearity problems while leading to simpler, more interpretable models. The advantage of elastic net is its systematic, algorithm-driven method for variable selection.

The results from elastic net and lasso selection from the variables in Table 13 in each of the 16 equity-bond quarterly combinations are summarized in Tables 16 and 17, respectively.[51] Of the 39 covariates in Table 13, elastic net selects 32 at least once across the 16 regressions; these variables are listed in the left-hand column of Table 16. Each of the next 16 columns includes a plus or minus sign if the corresponding variable is selected, otherwise the cell is blank. The right-hand column of Table 16 adds up the number of times the corresponding variable is selected by elastic net, i.e., the number of pluses and minuses in the row. For example, the financial variable 'total assets' is selected by elastic net twice in the 16 regressions, for the equity Q3-bond Q2 and equity Q3-bond Q3 combinations, and both effects are estimated to be positive.[52] The last row of Table 17 shows the number of covariates selected in each regression.

On average, elastic net selects 20 covariates per regressions (322 selections across the 16 regressions), or roughly half the number of covariates in the original Table 13 estimates. This, of course, is the main purpose of elastic net: to eliminate unnecessary variables and reduce multicollinearity. Five of the financial variables and one of the debt variables are selected in all 16 regressions. More importantly, equity ownership for banks, corporations, governments, hedge funds, insurance companies, investment advisor and pension funds are selected in at least half of the regressions, many more often than that. It is a similar story for bond ownership for corporations, hedge funds, insurance companies, investment advisors, and VC/E firms. The selection results therefore endorse our approach to the specification of the variables in the model and in particular that ownership variables add to the understanding of the reorganization decision.

At the investor type level, the pattern of signs in Table 16 for the equity and bond co-

[51] We use the elasticnet command in Stata 17. See StataCorp (2021) for further details.

[52] There is no general agreement on how to compute standard errors and marginal effects for the elastic net estimator. Thus, Tables 16 and 17 report only the signs of the elastic net logit coefficients.

variates reflects the marginal effects in Tables 14 and 15. Relatively higher share holdings by governments, hedge funds, investment advisors, and pension funds are always positively associated with exchange offers. Relatively higher share holdings by corporations and insurance companies are all negatively associated with exchange offers. Notice also how share holdings by individuals and VC/PE firms are only selected for equity Q1, which mirrors the statistical significance of the same two variables in Table 15.

For bond holdings the picture is similar: higher bond holdings by corporations, insurance companies, and investment advisors are all positively associated with exchange offers, as in Table 15. The only change between the elastic net coefficients and Table 15 is for hedge fund share holdings, which changes from a positive relationship to exchange offers in Table 15 across all 16 regressions to a negative effect with elastic net. Note also that both equity ownership for VC/PE firms is rarely selected in the elastic net regressions, though bond ownership for VC/PE firms is selected in half of the elastic net regressions with the same negative association to exchange offers as in Table 15.

Turning to the lasso selection in Table 17, the average of 16 variables selected per regression (259 selections across the 16 regression) is smaller than for elastic net, as expected, reflecting lasso's more aggressive screening. The number of variables selected by lasso is also more changeable than elastic net, ranging from a low of 6 to a high of 25 selections (compared with 16 and 29 for elastic net), reflecting the sensitivity of lasso selection to collinear variables. Otherwise the results are similar to elastic net. For shares, governments, hedge funds, investment advisors and pension funds are selected often and found to be positively associated with exchange offers. For bonds, higher holdings by corporations, insurance companies, and investment advisors are all positively associated with exchange offers; hedge funds bond holdings again having a negative relationship to exchange offers with the lasso estimates.

Indeed, the case of hedge funds is especially interesting: share holdings by hedge funds are positively associated with exchange offers, whereas bond holdings by hedge funds are positively associated with Chapter 11. An explanation could be that hedge funds behave opportunistically in restructuring depending on the circumstances, using bond holdings to support Chapter 11 and share holdings to support an exchange offer. This is consistent with the active role of hedge funds mentioned earlier.

8. Conclusion

We analyze the financially distressed firm's restructuring decision between Chapter 11 and an exchange offer. We control for a comprehensive set of factors that could influence the decision, such as financial characteristics and capital structure, but, unlike previous studies, we also include exhaustive data on equity and bond ownership by institutional investors. Also unlike earlier work, we use quarterly data, which allows us to begin to understand the complex relationships at play in what is a complex setting.

Several general remarks follow from our findings. First, because both equity ownership and bond ownership are linked to restructuring, and because the effects of ownership differ across investor type, it is important for empirical work on restructuring to consider ownership across types of investment as well as different types of investor. Our results endorse the approach of considering all possible influences at once, as opposed to concentrating on specific investment/investor effects, such as loans by banks, or shares held by hedge funds, in isolation.

Second, the timing of the effects of equity ownership and bond ownership are different. Some investor holdings are consistently related to exchange offers across all four quarters leading up to restructuring; some relationships only strongly emerge in Q1; other relationships that are strong at Q4 fade as restructuring approaches. Besides endorsing the use of quarterly data, these findings imply that investigating changes in asset ownership during the period leading up to restructuring may enhance our understanding of the process. In particular, the typical 'snapshot' approach in the literature, which considers variables measured at a single point (e.g., 3 months, 6 months, or 12 months) prior to restructuring, could miss relevant detail on the process.

Third, more generally, control of a firm through equity and control of the firm through bonds have demonstrably different associations with restructuring, hinting at promising ground for future research into issues of firm ownership and control beyond the restructuring process.

We believe we have uncovered some genuinely new and interesting findings. Generally speaking, bond holders favour Chapter 11 and equity holders favour exchange offers. Nevertheless there is much heterogeneity across investors: the holdings of individual investors have different associations with restructuring. Our analysis uncovers different behaviour across time, across investors, and across the assets controlled by those investors. To fully understand the complex restructuring process it is necessary to consider all of these angles. Investors have different objectives based on different motivations, all of which are obscured by an aggregate view that does not account for individual investor holdings.

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Table 1: Number of Chapter 11 and Exchange Offer cases by year

	Year of Distress		Year of Filing	
Year	Chapter 11	Exchange Offer	Chapter 11	Exchange Offer
1999	0	0	0	3
2000	11	12	2	10
2001	22	15	12	8
2002	9	6	14	10
2003	6	6	13	7
2004	5	6	6	3
2005	2	3	5	10
2006	1	1	2	2
2007	6	10	1	2
2008	14	13	2	11
2009	3	7	17	15
2010	6	8	5	4
2011	5	1	4	7
2012	7	8	7	6
2013	5	6	6	6
2014	12	5	5	4
2015	11	18	10	9
2016	6	13	15	18
2017	0	0	4	3
2018	0	0	1	0
Total	131	138	131	138

Table 2: Alpha Natural Resources Inc., bond holdings[1]

Investor	Q4	Q3	Q2	Q1
ALLIANZ SE	0	2,960	2,860	2,860
AMERICAN MONEY MANAGEMENT LLC	206	206	206	206
AMERIPRISE FIN GRP	9,600	5,200	5,200	5,200
AUTOMOBILE CLUB MICHIGAN GROUP	600	0	0	0
BARCLAYS PLC	650	650	650	650
BLACKROCK	350	350	350	0
CAPITAL GROUP COMPANIES INC	105,650	104,550	0	0
CATALYST CAPITAL ADV LLC	2,930	2,930	4,787	5,571
DIAMOND INSURANCE COMPANY	428	428	428	428
EUROMOBILIARE INTERNATIONAL FUND	1,130	0	0	0
FIL LIMITED	70	27	27	7,089
FMR LLC	4,807	4,557	4,766	4,804
GERMANIA INSURANCE GROUP	180	180	180	0
GUGGENHEIMINVESTMENT ADVISOR	0	0	0	1,250
INVESCO LTD	8	8	8	0
JACKSON NATIONAL GROUP	10,000	10,000	10,000	10,000
JPMORGAN CHASE & CO	85	0	0	0
KORNITZER CAPITAL MANAGEMENT INC	12,000	12,000	12,000	12,000
MOTORISTS MUTUAL GROUP	110	110	110	0
NATIONAL ASSET MANAGEMENT INC	0	4,500	0	0
NEUBERGER BERMAN GROUP LLC	75,906	8,976	0	0
NOMURA	850	925	3,025	3,025
NOMURA CORP. RESEARCH & ASSET	5,000	5,000	5,000	100
NORD EST ASSET MANAGEMENT SA	1,050	1,050	1,050	1,050
NORTHERN TRUST CORPORATION	795	0	0	0
PHILADELPHIA INDEMNITY INSURANCE	0	0	100	100
PRINCIPAL FINANCIAL GROUP INC	1,925	0	0	0
PRUDENTIAL PLC	5,000	5,350	5,350	5,350
SAFETY NATIONAL CASUALTY CORP	0	225	225	225
SMH CAPITAL ADVISORS INC	3,669	3,515	3,515	3,515
STATE OF CALIFORNIA	525	525	525	809
STATE STREET CORP	250	15,115	16,115	1,884
SUMMIT SECURITIES GROUP LLC	50	50	50	0
SWISS LIFE AG	3,000	3,000	3,000	3,000
UNITED SERVICES AUTOMOBILE ASSOC	5,000	4,000	4,000	4,000
WBL GROUP	2,610	2,610	2,610	2,610
YORKTOWN MANAGEMENT & RESEARCH C	1,000	1,000	0	0

[1] CUSIP: 02076XAD4; Amount issued: 500M; Coupon rate: 9.75%; Rank: Sr. unsecured; Maturity: April 15, 2018.

Table 3: List of standardized investor types used in the paper

Reported investor type (Source)	Standardized type
Banks/Investment Banks (CIQ)	Bank
Bank (Bloomberg)	Bank
Bank/Investment Advisor (Bloomberg)	Bank
Brokerage (CIQ and Bloomberg)	Brokerage
Business Development Corp (Bloomberg)	Corporation
Corporations (Bloomberg)	Corporation
Corporations - Private (CIQ)	Corporation
Corporations - Public (CIQ	Corporation
Holding Company (Bloomberg)	Corporation
Endowment (Bloomberg)	Endowment
Educational/Cultural Endowments (CIQ)	Endowment
Family Offices/Trusts (CIQ)	Family Offices/Trusts
Trust (Bloomberg)	Family Offices/Trusts
Charitable Foundations (CIQ)	Foundation
Foundations (Bloomberg)	Foundation
Company Controlled Foundations (CIQ)	Foundation
Government (Bloomberg)	Government
Hedge Fund (Bloomberg)	Hedge Fund
Hedge Fund Managers (< 5% stake) (CIQ)	Hedge Fund
Hedge Fund Managers (> 5% stake) (CIQ)	Hedge Fund
Individuals/Insiders (CIQ)	Individual/Insider
Chairman of the Board (Bloomberg)	Individual/Insider
Insurance Companies (CIQ)	Insurance Company
Insurance Company (Bloomberg)	Insurance Company
Investment advisor (Bloomberg)	Investment Advisor
REITs (CIQ)	Investment Advisor
Traditional Investment Managers (CIQ)	Investment Advisor
Other (Bloomberg)	Other
Unclassified (CIQ)	Other
Unknown (CIQ)	Other
Corporate Pension Sponsors (CIQ)	Pension Fund
Government Pension Sponsors (CIQ)	Pension Fund
Pension Fund (Bloomberg)	Pension Fund
Union Pension Sponsors (CIQ)	Pension Fund
Sovereign Wealth Funds (< 5% stake) (CIQ)	Sovereign Wealth Fund
Sovereign Wealth Fund (Bloomberg)	Sovereign Wealth Fund
Private Equity (Bloomberg)	VC/PE Firm
VC/PE Firms (< 5% stake) (CIQ)	VC/PE Firm
VC/PE Firms (> 5% stake) (CIQ)	VC/PE Firm
Venture capital (Bloomberg)	VC/PE Firm

Table 4: Number of bond holders and equity holders by investor type

Investor type	Bondholder	Equityholder	Total
Bank	45	137	182
Brokerage	5	4	9
Corporation	16	126	141
Endowment	1	13	14
Family office or trust	3	251	254
Foundation	7	11	18
Government	3	4	7
Hedge fund	153	777	930
Individual investor	1	3,056	3,057
Insurance company	642	142	784
Investment advisor	465	2,121	2,586
Other	6	8	14
Pension fund	12	68	80
Sovereign wealth fund	1	7	8
VC/PE firm	11	119	130
Total	1,370	6,844	8,214

Table 5: Descriptive statistics: Financial variables at Q1

	Chapter 11 (n = 131)			Exchange Offer (n = 138)			test for difference[2]	
Variable[1]	Mean	Median	Std. dev.	Mean	Median	Std. dev.	mean[3]	median[4]
Balance sheet								
Total assets	1,382.6	574.6	2,275.2	2,521.1	955.4	3,940.2	***	**
Cash and equivalent	103.2	27.6	194.5	239.7	53.7	892.4	*	**
Current assets	372.0	173.1	547.7	700.8	188.2	1,312.0	***	
Property, plant and equipment	1,428.1	444.7	2,514.2	2,088.5	521.9	3,585.9	*	
Cash and equivalent / Assets	9.7	5.4	13.2	12.8	5.6	19.4		
Current assets / Assets	35.3	30.4	21.8	35.7	27.0	26.5		
PPE / Assets	118.7	78.1	152.8	105.8	71.5	142.7		
Total liabilities	1,566.8	637.6	2,318.7	2,136.0	721.2	3,262.3	*	
Current portion LTD	649.5	205.9	1,128.3	125.2	5.1	504.9	***	***
Current liabilities	926.1	376.5	1,423.2	483.0	160.8	849.9	***	***
Long term debt	398.1	23.1	1,110.3	1,323.0	408.9	2,182.8	***	***
Current LTD / Liabilities	42.3	44.9	35.0	11.2	0.5	24.2	***	***
Current liabilities / Liabilities	64.6	79.3	33.6	34.3	19.9	30.8	***	***
LTD / Liabilities	24.6	3.5	31.7	54.3	63.7	29.9	***	***
Assets / Liabilities	89.1	86.9	36.8	132.4	115.1	89.7	***	***
Current assets / Current liabilities	137.2	46.3	633.0	240.6	134.3	355.0	*	***
Liabilities / Assets	138.7	115.1	86.9	97.9	86.9	69.9	***	***
Long term debt / Assets	36.4	4.0	75.6	49.9	47.2	34.8	*	***
Current liabilities / Assets	88.7	72.8	76.2	34.2	19.5	53.3	***	***
Income statement								
Revenue	198.9	85.9	310.6	351.7	102.8	695.8	**	
EBIT	−55.4	−8.0	296.1	−7.4	−1.9	115.7	*	*
EBITDA	3.1	−0.5	47.7	28.7	10.6	114.3	**	***
Interest expense	24.6	12.3	33.6	29.0	10.3	45.8		
Net income	−157.4	−40.2	400.0	−124.1	−20.4	318.3		
EBIT / Revenue	−46.0	−14.8	135.8	−57.5	−3.0	375.2		**
EBITDA / Revenue	−13.6	−1.0	55.8	−6.2	6.8	170.5		***
EBITDA / Interest expense	−66.7	−0.4	376.6	−9.7	65.8	1,235.5		***
Interest expense / Revenue	26.8	14.5	37.5	22.2	10.7	35.8		

[1] Levels are reported in millions of 2nd quarter, 2002 U.S. dollars, deflated by the (seasonally adjusted) GDP price deflator; ratios are reported in percent. (Source: Capital IQ.)
[2] Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.
[3] Mean comparison t test.
[4] Quantile regression t test for equality of medians.

Table 6: Descriptive statistics: Change in financial variables (Q1 − Q4)

	Chapter 11 (n = 131)			Exchange Offer (n = 138)			test for difference[2]	
Variable[1]	Mean[3]	Median	Std. dev.	Mean[3]	Median	Std. dev.	mean[4]	median[5]
Balance sheet								
ΔTotal assets	−463.2***	−164.9	754.2	−222.8	−74.3	1,643.8		**
ΔCash and equivalent	−24.9**	−4.9	142.3	−13.6	−3.2	460.6		
ΔCurrent assets	−88.1***	−25.0	201.6	−45.4	−23.1	503.1		
ΔProperty, plant and equipment	−151.4**	−7.3	731.2	−4.0	−0.3	1,303.0		
ΔCash and equivalent / Assets	0.0	0.1	7.7	0.3	−0.1	8.3		
ΔCurrent assets / Assets	2.3**	1.0	10.7	0.9	−0.3	10.6		*
ΔPPE / Assets	33.2***	10.5	101.3	19.6***	4.8	83.6		***
ΔTotal liabilities	−33.6*	−7.6	217.8	39.4	−4.9	963.3		
ΔCurrent portion LTD	594.1***	135.4	1,134.1	51.0	0.0	535.8	***	***
ΔCurrent liabilities	585.0***	121.0	1,183.2	38.8	−2.5	576.9	***	***
ΔLong term debt	−628.6***	−143.7	1,161.0	−4.2	−3.6	880.4	***	***
ΔCurrent LTD / Liabilities	34.9***	29.9	37.6	5.9***	0.0	25.4	***	***
ΔCurrent liabilities / Liabilities	34.6***	27.8	37.6	4.7**	−0.1	26.6	***	***
ΔLTD / Liabilities	−35.6***	−38.5	36.4	−4.1*	0.1	25.7	***	***
ΔAssets / Liabilities	−31.3***	−23.6	32.9	−14.8***	−13.8	43.4	***	***
Income statement								
ΔRevenue	−40.1***	−11.3	107.9	−41.0***	−4.9	158.7		
ΔEBIT	−25.2	0.1	327.8	−4.8	−0.9	153.2		*
ΔEBITDA	−7.4	−2.3	56.7	−9.1	−2.1	140.2		***
ΔInterest expense	0.0	0.3	8.5	2.0	0.2	18.0		
ΔNet income	−56.5	−3.7	444.8	−49.8	−0.9	384.9		
ΔEBIT / Revenue	166.1	−1.0	2,017.8	2.4	−2.4	451.9		
ΔEBITDA / Revenue	30.6	−1.9	353.9	19.5	−2.7	271.1		**
ΔEBITDA / Interest expense	75.9	−21.7	686.2	−54.7	−51.7	1,835.1		***
ΔInterest expense / Revenue	5.2**	2.1	24.7	−2.3	1.6	75.7		***

[1] Levels are reported in millions of 2nd quarter, 2002 U.S. dollars, deflated by the (seasonally adjusted) GDP price deflator; ratios are reported in percent. (Source: Capital IQ.)
[2] Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.
[3] Mean comparison t test for Q1 and Q4.
[4] Mean comparison t test for difference in the mean Q1-Q4 change between Chapter 11 and Exchange offer firms.
[5] Quantile regression t test for difference in the median Q1-Q4 change between Chapter 11 and Exchange offer firms.

Table 7: Descriptive statistics: Debt structure at Q1[1]

	Chapter 11 (n = 131)			Exchange Offer (n = 138)			test for difference[2]	
Variable[1]	Mean	Median	Std. dev.	Mean	Median	Std. dev.	mean[3]	median[4]
Debt outstanding	1,105.8	453.2	1,595.2	1,489.3	470.3	2,277.7		
Term loans	220.5	5.5	476.4	246.2	0.0	537.7		
Bonds and notes	741.7	286.2	1,174.8	1,091.1	368.1	1,683.8	**	
Senior debt	1,003.2	406.9	1,526.4	1,305.7	438.8	2,115.6		
Convertible debt	114.8	0.0	190.6	163.4	0.0	391.5		
Bank debt	351.3	121.8	591.6	363.7	57.0	711.1		
Secured debt	489.4	201.7	762.6	439.7	162.4	678.1		
Unsecured debt	625.0	219.6	1,067.9	1,075.6	350.8	1,882.9	**	*
Term loans / Debt out.	17.5	3.1	24.1	13.1	0.0	22.9		
Bonds and notes / Debt out.	62.9	68.8	36.3	68.6	80.4	35.8		*
Senior debt / Debt out.	85.0	100.0	28.6	84.1	100.0	35.9		
Convertible debt / Debt out.	21.2	0.0	33.5	21.0	0.0	36.8		
Bank debt / Debt out.	33.1	27.6	31.3	27.0	14.7	30.8		**
Secured debt / Debt out.	47.9	46.9	33.8	40.8	34.4	35.6	*	**
Unsecured debt / Debt out.	53.6	55.7	33.9	60.2	66.7	38.9		*
Debt out. / Liabilities	71.2	77.2	19.5	68.1	73.2	20.4		*
Debt out. / Assets	103.2	84.7	84.1	66.5	60.8	48.4	***	***
Secured debt / Assets	47.9	29.8	52.3	28.2	19.6	32.1	***	*

[1] Levels are reported in millions of 2nd quarter, 2002 U.S. dollars, deflated by the (seasonally adjusted) GDP price deflator; ratios are reported in percent. The number of shares outstanding is reported in millions. (Source: Capital IQ, Balance Sheet, Supplemental Items.)

[2] Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.

[3] Mean comparison t test.

[4] Quantile regression t test for equality of medians.

Table 8: Chapter 11 and Exchange Offer cases with reported bond or equity holdings, by investor type

	Chapter 11 (n = 131)				Exchange Offer (n = 138)			
Variable	Q4	Q3	Q2	Q1	Q4	Q3	Q2	Q1
Bonds	97	97	97	97	100	100	100	100
Bank	80	77	76	74	80	84	83	84
Brokerage	7	7	7	5	0	1	1	1
Corporation	20	20	17	15	36	38	38	37
Endowment	0	0	0	0	0	0	0	0
Family trust	12	11	9	8	12	12	12	14
Foundation	11	11	9	9	15	14	13	16
Government	17	17	15	14	16	15	15	16
Hedge fund	55	57	58	53	60	62	62	64
Individual investor	3	3	2	1	0	0	0	0
Insurance company	80	82	81	80	79	83	83	87
Investment advisor	94	95	94	94	90	93	93	92
Others	0	0	2	1	2	1	1	2
Pension fund	6	6	8	9	7	9	10	14
Sovereign fund	0	0	0	0	0	0	0	0
VC/PE firm	19	17	19	17	10	13	14	14
Equity	131	131	131	131	138	138	138	138
Bank	125	123	119	113	135	132	131	127
Brokerage	25	22	16	14	31	36	26	25
Corporation	39	42	39	38	51	54	54	56
Endowment	15	10	7	3	41	35	31	24
Family trust	75	72	63	65	91	95	93	88
Foundation	3	5	5	3	9	9	10	8
Government	28	29	30	27	41	42	43	40
Hedge fund	112	109	110	102	122	121	125	123
Individual investor	123	125	126	124	120	124	124	128
Insurance company	72	66	61	50	91	91	87	79
Investment advisor	131	131	130	129	137	137	138	138
Others	25	34	32	35	9	9	11	16
Pension fund	96	92	90	88	112	112	113	114
Sovereign fund	4	3	2	1	8	8	8	10
VC/PE firm	53	45	39	37	62	60	51	56

Table 9: Bonds and shares information at Q1

	Chapter 11			Exchange Offer			test for difference[2]	
Variable	Mean	Median	Std. dev.	Mean	Median	Std. dev.	mean[3]	median[4]
Bonds[1]								
Value of bonds issued	1,034.4	474.2	1,382.6	1,486.6	560.2	1,979.5	*	
Value of bonds outstanding	892.7	412.5	1,200.7	1,240.5	500.0	1,609.7	*	
Number of bonds issued	2.9	2	2.4	3.4	2	3.0		
Amount issued per bond	309.7	267.1	215.0	360.0	278.6	241.0		
Amount outstanding per bond	273.6	220.4	202.3	311.5	247.7	212.3		
Number of bondholders	44.1	28.0	46.9	72.0	51.5	67.8	***	***
Amount issued per bondholder	28.1	19.9	29.3	21.0	15.2	19.8	**	**
Amount outstanding per bondholder	22.5	16.7	19.2	17.2	13.7	13.8	**	
Value of bonds reported	277.9	107.2	465.2	502.3	204.0	738.2	**	**
% Bonds in default	87.8	100.0	29.4	11.0	0.0	30.2	***	na
Equity[5]								
Number of shares outstanding	67.5	38.3	97.0	93.2	29.4	329.3		
Number of shares reported	30.1	15.1	55.2	54.8	15.0	146.6	*	

[1] Based on 97 Chapter 11 firms and 100 Exchange Offer firms that issued bonds. Value of bonds issued (outstanding) is the total value of bonds issued (outstanding) by (at) the company (Bloomberg historical data). Number of bond holders and value of reported bonds are based on self-reported holdings at Q1. Bond values are in millions of current U.S. dollars.

[2] Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.

[3] Mean comparison t test.

[4] Quantile regression t test for equality of medians.

[5] Based on 131 Chapter 11 and 138 Exchange Offer firms. Number of shares reported is based on self-reported holdings at Q1. Share numbers are in millions of shares.

Table 10: Mean bond holdings (percent of total outstanding) reported by investor type[1]

	Chapter 11				Exchange offer				difference: Exof – Ch11[2]			
Investor type	*Q*4	*Q*3	*Q*2	*Q*1	*Q*4	*Q*3	*Q*2	*Q*1	*Q*4	*Q*3	*Q*2	*Q*1
n	97	97	97	96	96	99	99	100	193	196	196	196
Bank	4.03	2.92	3.69	2.67	5.29	5.32	5.32	4.59	1.26	2.40**	1.63	1.92**
Corporation	0.15	0.18	0.17	0.16	0.56	0.51	0.55	0.48	0.41*	0.33	0.38*	0.33
Hedge fund	9.07	9.42	9.08	9.17	6.12	6.00	5.54	5.19	−2.95	−3.42	−3.53	−3.98*
Insurance company	6.43	4.96	4.79	4.08	8.11	7.90	8.21	8.28	1.68	2.94***	3.42***	4.20***
Investment advisor	16.56	16.95	17.52	14.12	22.38	22.96	23.62	22.68	5.82***	6.01**	6.10*	8.56***
Pension fund	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.01	0.01	0.03	0.02
VC/PE firm	0.33	0.44	0.31	0.35	0.23	0.24	0.31	0.42	−0.09	−0.20	0.01	0.06
The Rest	0.15	0.14	0.12	0.10	0.11	0.12	0.36	0.37	−0.04	−0.01	0.24	0.27
Total	36.74	35.04	35.69	30.67	42.84	43.09	43.95	42.06	6.10*	8.05**	8.26*	11.39***

[1] For each firm in each quarter, the holding by an investor type is the sum of the face value of bonds reported by all the investors of that type divided by the total value of bonds outstanding (reported as a percentage).

[2] Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.

Table 11: Mean share holdings (percent of total outstanding) reported by investor type[1]

	Chapter 11 (n = 131)				Exchange offer (n = 138)				difference: Exof − Ch11[2]			
Investor type	$Q4$	$Q3$	$Q2$	$Q1$	$Q4$	$Q3$	$Q2$	$Q1$	$Q4$	$Q3$	$Q2$	$Q1$
Bank	5.34	4.55	3.95	3.16	6.35	5.99	5.58	5.58	1.01	1.44*	1.64**	2.42***
Corporation	4.82	4.91	4.72	4.39	2.33	2.50	2.54	3.63	−2.49	−2.42	−2.18	−0.75
Family trust	0.68	0.68	0.66	0.68	0.85	0.77	0.76	0.75	0.17	0.09	0.10	0.07
Government	0.26	0.24	0.15	0.20	0.62	0.65	0.66	0.69	0.36	0.41*	0.51**	0.49**
Hedge fund	9.69	9.05	7.68	5.28	10.63	11.25	9.46	9.04	0.94	2.19	1.78	3.76***
Individual	9.39	9.62	9.91	10.17	9.58	9.77	10.10	10.35	0.19	0.15	0.19	0.18
Insurance company	0.98	1.11	0.91	0.68	0.63	0.64	0.76	0.63	−0.35	−0.48	−0.15	−0.04
Investment advisor	27.50	23.95	19.99	15.41	38.12	37.70	34.89	30.35	10.63***	13.75***	14.90***	14.93***
Pension fund	0.93	0.94	0.73	0.65	1.90	1.79	1.76	1.64	0.96**	0.85**	1.03***	1.00***
VC/PE firm	4.67	4.75	4.62	3.94	3.07	3.05	2.98	3.07	−1.60	−1.70	−1.64	−0.87
The Rest	0.26	0.35	0.28	0.25	0.30	0.24	0.21	0.24	0.03	−0.11	−0.07	−0.02
Total	64.53	60.16	53.60	44.81	74.38	74.34	69.72	65.97	9.85**	14.19***	16.12***	21.16***

[1] For each firm, the holding by type of investor is the total number of shares held by the investor type in a given quarter divided by the total number of shares outstanding at the firm.

[2] Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.

Table 12: Logit marginal effects[1]—financial, debt, investor holdings, and bond variables measured at Q1.

Equity quarter:			$Q1$	$Q1$
Variable[2] Bond quarter:				$Q1$
Total assets	0.012	0.015	0.0004	0.032
Current assets / Assets	0.033	0.082	0.210	0.396*
PPE / Assets	0.011	0.014	0.010	−0.006
Current LTD / Liabilities	−0.724***	−0.749***	−0.715***	−0.747***
Assets / Liabilities	0.513***	0.543***	0.550***	0.638***
EBIT / Revenue	−0.028***	−0.028***	−0.043***	−0.054***
EBITDA / Interest expense	0.019***	0.018***	0.023***	0.025***
Debt outstanding / Liabilities		0.278	0.254	0.398*
Bonds and notes / Debt outstanding		0.087	0.229	0.208
Senior debt / Debt outstanding		−0.192	−0.182	−0.064
Bank debt / Debt outstanding		−0.042	−0.075	−0.242
Unsecured debt / Debt outstanding		−0.040	−0.095	−0.102
% shares Banks			1.535*	0.750
% shares Corporations			1.510*	1.112
% shares Family trusts			−0.094	−2.816
% shares Governments			7.042***	7.568***
% shares Hedge funds			2.179***	1.991**
% shares Individuals			1.917***	1.411*
% shares Insurance companies			−0.081	−0.687
% shares Investment advisors			1.468**	1.147*
% shares Pension funds			5.553**	8.205**
% shares VC/PE firms			2.493***	2.180**
% shares held by bond investors			−0.627	−0.569
% shares Top 5			−1.650**	−1.348
% bonds Banks				1.529
% bonds Corporations				10.673**
% bonds Hedge funds				1.045
% bonds Insurance companies				2.227*
% bonds Investment advisors				1.739
% bonds VC/PE firms				−2.281
% bonds held by equity investors				−1.391***
% bonds Top 5				−1.077
No. of bonds				−0.097***
No. of bondholders				0.001
No. of subordinate bonds				0.187**
No. of secured bonds				0.059
Pre-crisis dummy	−0.098	−0.117	0.126	0.184
Crisis dummy	−0.011	−0.004	0.084	0.194
Post-crisis dummy	−0.083	−0.070	−0.067	0.016
$\log L$	−136.839	−134.435	−114.407	−104.263
pseudo-R^2	0.266	0.279	0.386	0.441
adjusted pseudo-R^2	0.207	0.193	0.236	0.226
AIC	1.099	1.119	1.059	1.073
k	10	15	27	39

[1] $n = 269$. Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.

[2] All variables are measured at Q1, the most recent quarterly observation before the restructuring decision.

Table 13: Logit marginal effects[1]—matching quarter equity and bond ownership models.

	Equity quarter:	Q1	Q2	Q3	Q4
Variable[2]	Bond quarter:	Q1	Q2	Q3	Q4
Total assets		0.032	0.041	0.034	0.026
Current assets / Assets		0.396*	0.399*	0.425*	0.361
PPE / Assets		−0.006	−0.014	0.011	0.003
Current LTD / Liabilities		−0.747***	−0.844***	−0.802***	−0.964***
Assets / Liabilities		0.638***	0.694***	0.761***	0.841***
EBIT / Revenue		−0.054***	−0.053***	−0.039***	−0.039***
EBITDA / Interest expense		0.025***	0.023***	0.026***	0.027***
Debt outstanding / Liabilities		0.398*	0.501**	0.221	0.271
Bonds and notes / Debt outstanding		0.208	0.256	0.289*	0.330*
Senior debt / Debt outstanding		−0.064	−0.051	−0.079	−0.109
Bank debt / Debt outstanding		−0.242	−0.294	−0.153	−0.142
Unsecured debt / Debt outstanding		−0.102	−0.126	−0.144	−0.168
% shares Banks		0.750	−1.397*	−1.076**	−1.383**
% shares Corporations		1.112	−1.118	−1.102*	−1.950**
% shares Family trusts		−2.816	−1.580	−2.739*	−1.855
% shares Governments		7.568***	10.910***	8.431***	7.689**
% shares Hedge funds		1.991**	0.597	0.471	−0.236
% shares Individuals		1.411*	0.085	0.034	−0.344
% shares Insurance companies		−0.687	−1.303	−2.673*	−2.326
% shares Investment advisors		1.147*	0.400	0.319	−0.089
% shares Pension funds		8.205**	8.898***	2.753	13.577***
% shares VC/PE firms		2.180**	0.712	0.431	0.418
% shares held by bond investors		−0.569	−0.368	−1.201**	−1.124**
% shares Top 5		−1.348	0.067	0.370	0.695**
% bonds Banks		1.529	0.393	1.376	0.815
% bonds Corporations		10.673**	11.071***	14.128***	18.609***
% bonds Hedge funds		1.045	0.355	0.481	0.760
% bonds Insurance companies		2.227*	1.308	0.981	0.700
% bonds Investment advisors		1.739	0.936*	1.597*	2.360**
% bonds VC/PE firms		−2.281	−7.188**	−8.315**	−9.658**
% bonds held by equity investors		−1.391***	−1.418***	−0.281	−0.310
% bonds Top 5		−1.077	−0.274	−0.963	−1.418
No. of bonds		−0.097***	−0.112***	−0.097***	−0.108***
No. of bondholders		0.001	0.002	0.002	0.002
No. of subordinate bonds		0.187**	0.226***	0.212**	0.234***
No. of secured bonds		0.059	0.089	0.077	0.110
Pre-crisis dummy		0.184	0.011	−0.030	0.002
Crisis dummy		0.194	0.158	0.097	0.264
Post-crisis dummy		0.016	0.069	0.009	0.090
$\log L$		−104.263	−106.028	−108.175	−102.808
pseudo-R^2		0.441	0.431	0.420	0.448
adjusted pseudo-R^2		0.226	0.216	0.205	0.234
AIC		1.073	1.086	1.102	1.062
k		39	39	39	39

[1] $n = 269$. Statistical significance denoted by *** at the 1% level, ** at the 5% level, and * at the 10% level.

[2] Financial and debt variables are measured at Q1. Shares (bonds) variables are measured at the quarter listed in the 'Equity quarter' ('Bonds quarter') row.

Table 14: Equity ownership marginal effects, sign, and significance counts (grouped by equity quarter) for all 16 quarterly logit regressions

Equity quarter:	Q1				Q2				Q3				Q4			
Bonds quarter:	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Investor																
Banks	0.8	1.1	1.0	1.1	−1.5*	−1.4*	−1.4*	−1.2	−1.0*	−1.1*	−1.1*	−1.0*	−1.3*	−1.4*	−1.4*	−1.4*
Corporations	1.1	1.4	1.4	1.6*	−1.1	−1.1	−0.9	−0.9	−1.2*	−1.3*	−1.1*	−1.1*	−1.9*	−2.0*	−1.8*	−2.0*
Family trusts	−2.8	−2.6	−2.3	−2.4	−2.2	−1.6	−1.8	−1.9	−3.4*	−2.6	−2.7*	−2.8	−2.3	−1.7	−1.8	−1.9
Governments	7.6*	8.1*	7.5*	7.8*	10.9*	10.9*	10.2*	10.3*	8.9*	8.9*	8.4*	8.4*	7.8*	8.1*	7.5*	7.7*
Hedge funds	2.0*	2.1*	2.2*	2.4*	0.7	0.6	0.7*	0.8*	0.4	0.3	0.5	0.5	−0.3	−0.4	−0.2	−0.2
Individuals	1.4*	1.7*	1.7*	1.9*	−0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.1	−0.4	−0.3	−0.4	−0.3
Insurance companies	−0.7	0.1	0.1	0.2	−1.7	−1.3	−1.2	−1.0	−2.8*	−2.8*	−2.7*	−2.7	−2.5*	−2.2*	−2.5*	−2.3
Investment advisors	1.1*	1.4*	1.4*	1.6*	0.3	0.4	0.4	0.5*	0.3	0.3	0.3	0.4	−0.1	−0.2	−0.1	−0.1
Pension funds	8.2*	7.1*	6.3*	7.2*	10.2*	8.9*	8.0*	8.1*	3.1	2.8	2.8	2.6	14.0*	14.4*	12.7*	13.6*
VC/PE firms	2.2*	2.5*	2.4*	2.8*	0.6	0.7	0.6	0.8	0.4	0.4	0.4	0.5	0.3	0.3	0.3	0.4
−	2	1	1	1	5	4	4	4	4	4	4	4	7	7	7	7
sig. at 10% level	0	0	0	0	1	1	1	0	4	3	4	2	3	3	3	2
+	8	9	9	9	5	6	6	6	6	6	6	6	3	3	3	3
sig. at 10% level	6	6	6	7	2	2	3	4	1	1	1	1	2	2	2	2

Table 15: Bond ownership marginal effects, sign, and significance counts (grouped by bonds quarter) for all 16 quarterly logit regressions

Bonds quarter:	Q1				Q2				Q3				Q4			
Equity quarter:	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Investor																
Banks	1.5	2.0*	2.1*	2.1*	0.4	0.4	0.4	0.5	1.1	1.2	1.4	1.4	0.8	0.8	0.8	0.8
Corporations	10.7*	12.2*	12.8*	13.8*	13.2*	11.1*	11.9*	12.8*	14.2*	13.4*	14.1*	15.5*	17.3*	14.8*	15.5*	18.6*
Hedge funds	1.0	1.3	1.2	1.5*	0.5	0.4	0.3	0.4	0.5	0.6	0.5	0.7	0.7	0.6	0.5	0.8
Insurance companies	2.2*	3.2*	3.0*	3.4*	0.6	1.3	1.2	1.4*	0.3	1.1	1.0	1.5	−0.1	0.3	0.2	0.7
Investment advisors	1.7	2.5*	2.4*	2.8*	0.8	0.9*	0.9	1.1*	1.1	1.7*	1.6*	2.0*	1.7*	1.9*	1.8*	2.4*
VC/PE firms	−2.3	−2.1	−2.6	−2.1	−10.0*	−7.2*	−8.1*	−8.1*	−10.1*	−8.1*	−8.3*	−8.8*	−10.7*	−8.4*	−8.9*	−9.7*
−	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
sig. at 10% level	0	0	0	0	1	1	1	1	1	1	1	1	2	1	1	1
+	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5
sig. at 10% level	2	4	4	5	1	2	1	3	1	2	2	2	2	2	2	2

Table 16: Elastic net variable selection and coefficient signs for all 16 quarterly logit regressions

Equity quarter:	Q1				Q2				Q3				Q4				
Bonds quarter:	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Variable																	# sel.
Total assets										+	+						2
Current LTD / Liabilities		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16
Assets / Liabilities	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
EBIT / Revenue	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16
EBITDA / Interest expense	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
Debt outstanding / Liabilities	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
Bonds and notes / Debt outstanding									+	+	+	+	+	+	+	+	8
Bank debt / Debt outstanding	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16
% shares Banks	+		+	+						–	–		–	–	–	–	9
% shares Corporations					–	–	–	–	–	–	–	–	–	–	–	–	12
% shares Family trusts										–	–						2
% shares Governments	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
% shares Hedge funds	+	+	+	+	+	+	+	+	+	+	+	+					12
% shares Individuals	+	+	+	+													4
% shares Insurance companies									–	–	–	–	–	–	–	–	8
% shares Investment advisors	+	+	+	+	+	+	+	+	+	+	+	+					12
% shares Pension funds	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
% shares VC/PE firms	+	+	+	+													4
% shares held by bond investors										–	–				–		3
% shares Top 5					+	+	+	+	+	+	+	+	+	+	+	+	12
% bonds Banks			+				+				+				+		4
% bonds Corporations	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
% bonds Hedge funds	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16
% bonds Insurance companies	+	+		–	+	+		–	+	+	+	–	+	+	+	–	14
% bonds Investment advisors	+		+	+	+		+	+	+	+	+	+	+	+	+	+	14
% bonds VC/PE firms			–	–				–		–	–	–			–	–	8
% bonds held by equity investors										–							1
No. of bonds				–						–	–				–		4
No. of bondholders									+	+	+			+	+		5
No. of subordinate bonds	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
Pre-crisis dummy										–							1
Crisis dummy				+						+	+		+	+	+	+	7
No. selected	18	16	19	21	17	16	17	18	20	29	28	20	19	20	24	20	322

Table 17: Lasso variable selection and coefficient signs for all 16 quarterly logit regressions

Equity quarter:	Q1				Q2				Q3				Q4				
Bonds quarter:	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Variable																	# sel.
Total assets																	0
Current LTD / Liabilities		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	16
Assets / Liabilities	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
EBIT / Revenue	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	15
EBITDA / Interest expense				+	+	+			+		+	+	+	+	+	+	10
Debt outstanding / Liabilities				+	+	+	+		+		+	+	+	+		+	10
Bonds and notes / Debt outstanding									+		+	+	+	+	+	+	7
Bank debt / Debt outstanding	–		–	–	–	–	–	–	–		–	–	–	–	–	–	14
% shares Banks									–			–		–		–	4
% shares Corporations					–	–	–	–	–		–	–	–	–	–	–	11
% shares Family trusts												–					1
% shares Governments	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	16
% shares Hedge funds	+	+	+	+	+	+	+	+	+		+	+					11
% shares Individuals																	0
% shares Insurance companies									–		–	–	–	–	–	–	7
% shares Investment advisors	+	+	+	+	+	+	+	+	+	+	+	+					12
% shares Pension funds	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	15
% shares VC/PE firms																	0
% shares held by bond investors																–	1
% shares Top 5					+				+		+	+	+	+	+	+	8
% bonds Banks									+		+				+		3
% bonds Corporations	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	15
% bonds Hedge funds	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	15
% bonds Insurance companies	+	+			+	+			+	+	+	–	+	+	+	–	12
% bonds Investment advisors	+		+	+	+		+	+	+		+	+	+	+	+	+	13
% bonds VC/PE firms												–				–	2
% bonds held by equity investors																	0
No. of bonds												–				–	2
No. of bondholders			+						+	+	+	+		+	+		7
No. of subordinate bonds				+	+	+	+	+	+		+	+	+	+	+	+	12
Pre-crisis dummy																	0
Crisis dummy												+	+	+		+	4
No. selected	12	10	12	14	17	15	14	13	22	6	21	25	18	20	18	22	259

Appendix

Reporting issue [example problem]	Rule adopted [solution]
Bonds	
Nothing reported in 1 quarter [100, 0, 400, 500, 500]	Extrapolate the data from the previous quarter [100, 100, 400, 500, 500]
Nothing reported for 2 quarters [100, 0, 0, 400, 300]	Extrapolate the data from two previous quarters [100, 100, 100, 400, 300]
Data reported on a 6-months basis [100, 0, 100, 0, 100]	Extrapolate the data for the missing quarters [100, 100, 100, 100, 100]
Data reported on a yearly basis [100, 0, 0, 0, 100]	Extrapolate the data for the missing quarters [100, 100, 100, 100, 100]
Bonds issued in an exchange offer replacing existing bonds.	Keep the two bonds separate. The position of each investor is reported for the original bond (before the exchange offer) and for the new bond (after the exchange offer).
Equity	
CIQ does not report the total number of shares for some quarters prior to the event.	If the Excel file of detailed shareholdings by individual investors is available in CIQ, sum the shares held by investors and divide by the percentage of common shares outstanding. If not, use the information for the most recent quarter available. CIQ does not report detailed equity holdings before March 2003, in which case the information is from Bloomberg.

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