Do Market Prices Improve the Accuracy of Court Valuations in Chapter 11?*

Cem Demiroglu† Julian Franks‡ Ryan Lewis§

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Abstract

This paper shows that public dissemination of trading information for registered corporate bonds reduces valuation errors in Chapter 11 bankruptcy reorganizations by about half, virtually eliminating unintended wealth transfers between claimants and consequent violations of the absolute priority rule. The impact of dissemination is significantly greater where alternative market-based indicators of firm valuation, such as analyst estimates or outside bids for the companys assets are lacking, and significantly lower where hedge funds receive a significant equity share in the reorganized company. The results suggest that the transparency of market prices helps improve the distributional efficiency of Chapter 11 bankruptcy and provide support for proposals to increase the availability of market-based signals to aid the valuation process.

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†College of Administrative Sciences and Economics, Koc University, Sariyer, Istanbul, Turkey 31450, phone: +90-212-338-1620, fax: +90-212-338-1653, e-mail: cdemiroglu@ku.edu.tr.

‡Institute of Finance and Accounting, London Business School, London, United Kingdom, phone: +44-20-7262-5050, fax: +44-20-7724-3317, e-mail: jfranks@london.edu.

§Leeds School of Business University of Colorado, Boulder, Colorado phone: +1 (303) 492 2820, e-mail: ryan.c.lewis@colorado.edu.

[T]he valuation of an enterprise . . . is an exercise in educated guesswork. At worst it is not much more than crystal ball gazing. There are too many variables, too many moving pieces in the calculation of value . . . for the court to have great confidence that the result of the process will prove accurate in the future.

– Judge D. Michael Lynn, U.S. Bankruptcy Court for the Northern District of Texas

1. Introduction

One goal of an efficient bankruptcy procedure is to divide the reorganization pie optimally among various claimants (see, e.g., Aghion, Hart, and Moore (1992), Hart (2000)). In US Chapter 11 bankruptcy procedures, the court must place a hypothetical value on the reorganized firm and issue new securities to the different claimants based on that hypothetical value. However, there is considerable difficulty in placing an objective and reliable value on the reorganized company, particularly when pre-bankruptcy claims, such as outstanding bonds, are either not traded or the market prices of trades are not publicly available during the bankruptcy process. The matter is further complicated by claimholders' incentives to misstate the value of the reorganized company to the court (Gilson, Hotchkiss, and Ruback (2000)). Indeed, Butler (2003) finds that court-determined valuations of the newly-issued common stocks of reorganized companies often differ substantially from the market values of those stocks shortly after emergence from Chapter 11, suggesting the presence of large court valuation errors in Chapter 11, which affect recovery rates to different creditors. To the extent they are anticipated prior to bankruptcy, the valuation errors may increase ex ante borrowing costs (Douglas, Gertner, and Picker (1994)) and distort incentives of creditors to monitor (Cornelli and Felli (1997)) and managers' incentives to invest (Bebchuk and Chang (1992)).[1]

To improve the distributional efficiency of Chapter 11, prior studies have suggested settling reorganization outcomes through the distribution of option-like securities to creditors (see, e.g., Bebchuk (1988, 2002) and Aghion et al. (1992)), the direct auction of a firm's assets following bankruptcy filing (see, e.g., Baird (1986) and Eckbo and Thorburn (2009)), or by the public listing of a small portion of newly-issued equity before emergence to serve as an efficient price signal of

[1]Structural debt pricing models often include expected costs of bankruptcy and deviations from strict absolute priority (see, e.g., Leland (1994)).

the true reorganization value (see, e.g., Roe (1983)). All of these policy prescriptions are based on the argument that capital markets are better equipped than alternatives, such as bargaining and judicial determination, to value a publicly listed debtor. However, there is no empirical study providing a comparison of these alternative valuation approaches.

In this paper, we provide evidence that an alternative market-based mechanism—adding transparent and verifiable transaction data for the debtor's bonds during the Chapter 11 process—substantially reduces the court valuation errors, virtually eliminating unintended wealth transfers between different claimants and thereby avoiding consequent violations of the absolute priority rule (APR).[2] We also present evidence that the dissemination of bond prices matters more for court valuation errors where there are fewer alternative market-based sources of information on firm value such as analyst following and outside bids for the company's assets. Finally, we show that dissemination matters considerably less where hedge funds receive a significant equity share in the reorganized company, consistent with the evidence in Jiang, Li, and Wang (2012) that the presence of hedge funds helps reduce distortions arising from conflicts of interest between the debtor and secured creditors.

The link between court misvaluation and distributional considerations can best be illustrated with an example. iPCS, Inc. ("iPCS") filed for Chapter 11 bankruptcy on February 23, 2003. On July 9, 2004, the bankruptcy court confirmed iPCS' plan of reorganization. As a result of the reorganization, iPCS' senior secured credit facility was repaid in full in cash and terminated, and its senior discount notes were canceled and the holders received nine million shares of newly-issued common stock. Additionally, all of iPCS' subordinated claims were discharged and all of its then existing capital stock was canceled. The court-determined value of newly-issued common stocks, stated in the final plan of reorganization, was $95 million, but on emergence from Chapter 11 market participants valued those stocks at roughly $330 million, reflecting a substantial court valuation error. The misvaluation had important implications for the recovery rates to junior and senior claimants. Because the plan value was relatively low compared with the total value of creditor claims, all of the newly-issued common stocks were received by senior creditors, and none were given to junior creditors or pre-bankruptcy equityholders.[3] Based on the market value of common

[2]The absolute priority rule mandates that absent the consent of senior creditors, junior claimants are entitled to no bankruptcy distribution unless and until the senior creditors are paid in full.

[3]The plan of reorganization authorized iPCS to issue ten million shares of common stock upon emergence from

stocks, post-emergence recovery rates for senior creditors' claims were 154% of their claim amount of $214 million allowed by the bankruptcy court. If the market value of the common stocks had been anticipated in the court plan, more than one third of the newly-issued common stocks or $116 million would have been given to junior claimants. This $116 million transfer of wealth from junior to senior claimants represents an unintended APR violation that results from a misvaluation.

Following the above example, we calculate misvaluation and wealth transfers between claimants for a sample of 86 publicly traded firms that emerged from Chapter 11 during 2001-2010. We define misvaluation as the difference between the hypothetical value of the newly-issued common stocks, listed in the court approved plan of reorganization, and the market value of those stocks on emergence from Chapter 11 (in absolute value), scaled by the average of the two values. We focus our measures of misvaluation on newly issued common stock, which account for approximately 65% of the plan enterprise value.

We begin by documenting substantial court misvaluations in our sample of Chapter 11 reorganizations. For example, we find that the average (median) court misvaluation of newly-issued common stocks in Chapter 11 reorganizations is 49.8% (33.1%). These findings closely mimic those of Butler (2003) that examines a sample of 97 Chapter 11 reorganizations during 1990-1997 and finds an average misvaluation of 44.5%. As illustrated in the iPCS example above, large misvaluations may result in inter-claimant wealth transfers and, consequently, deviations from the strict absolute priority rule.[4] We distinguish between intended deviations from strict absolute priority that are part of the consensual court plan of reorganization and unintended deviations that solely result from misvaluation. Past studies conflate these two sources of wealth transfers despite potentially different efficiency implications. In our sample, intended and unintended APR violations occur with similar frequency (in about 20% of the reorganizations). However, the average size of inter-claimant wealth transfers, scaled by the market value of newly-issued common stocks upon emergence, is substantially larger in unintended violations than in unintended violations (49.6% vs. 4.3%, respectively).

One explanation for large court misvaluations and resulting wealth transfers in Chapter 11 is

bankruptcy. The remaining one million shares were reserved for issuance to certain members of iPCS' management, directors through the company's 2004 Long-Term Incentive Plan.

[4]Butler (2003) does not calculate wealth transfers and deviations from absolute priority consequent on misvaluations.

the limited availability of market-based information guiding bankruptcy participants (Gilson et al. (2000)). The primary conjecture of this study is that public availability of bond prices is a powerful market-based measure of firm value because the outstanding amount of traded debt is a significant fraction of the overall enterprise value of firms in Chapter 11 (e.g., 53% according to Demiroglu and James (2015)). Bond prices might be used to determine not only the fair value of their claims but also the implied market value of non-traded securities and other claims.[5] However, evaluating the true impact of the availability of market prices of debt on court misvaluation is affected by a selection problem where firms with publicly traded debt may be fundamentally different from those without such debt.

We address this selection problem by using the introduction of the Trade Reporting and Compliance Engine (TRACE) that publicly disseminates all over-the-counter (OTC) corporate bond transactions as a quasi-natural experiment. Before the introduction of TRACE dissemination, almost all corporate bonds were traded in opaque markets without publicly disseminated transaction information: only a limited set of institutional investors had access to trade quotes (or "matrix prices") from a few large brokerage firms resulting in substantial uncertainty regarding fair bond prices. In July 2002, FINRA (formerly known as NASD) initiated a program that mandated timely reporting by dealers of all registered bond transactions which were then publicly disseminated through TRACE. While transaction data on all TRACE-eligible bonds have been collected by TRACE since July 1, 2002, dissemination of the data was implemented in phases with mostly actively traded, large, investment grade bonds falling into the first wave in 2002, followed by smaller investment grade bonds in 2003, and ending with all registered bonds regardless of size or rating over the subsequent year and a half.[6] The phased dissemination was implemented to minimize disruption to corporate bond markets and assess the impact of transaction disclosure on market conditions within these markets. As discussed below, we are able to utilize this staggered implementation to assess the effect of dissemination on the accuracy of court valuation. Since the timing of dissemination was based on observable bond characteristics such as rating, original issue size, and liquidity, conditional on these factors, TRACE dissemination is likely to be independent of the

[5]For example, assuming absolute priority holds, senior unsecured bonds trading below par indicates that the secured creditors will likely be paid in full, whereas subordinated debt holders and old equityholders will likely receive little or no distribution in the reorganization plan. Also, the enterprise value of the debtor will likely be roughly equal to the par value of secured debt (plus accumulated interest) and the market value of unsecured debt.

[6]We provide a more complete description of the TRACE program in Section 2.

difficulty in valuing the debtor in Chapter 11.

Past studies provide evidence that the introduction of TRACE dissemination has significantly reduced price dispersion, especially for high yield bonds, in part by diminishing information asymmetries and reducing the scope for manipulation (see, e.g., Asquith, Covert, and Pathak (2013), Bessembinder, Maxwell, and Venkataraman (2006), Goldstein, Hotchkiss, and Sirri (2007), Cici, Gibson, and Merrick (2011)). Bessembinder and Maxwell (2008) provide anecdotal evidence consistent with these findings: For example, a commentator from a fixed income research service (as quoted by Bravo (2003)) stated: "... before TRACE, it wouldn't be unheard of for a trader to use the fact that there was no way of verifying the information that he gave about where a bond was trading to his advantage..." Also, referring to the post-TRACE era, a fixed-income trader quoted in Vames (2003) stated: "You don't have to go to three or four different people to find out where something is trading... [W]hen you have access to TRACE information, you have a better idea where things are before you make your first call." Finally, a bond trader quoted in Laughlin (2005) stated: "... [M]any investors now think the real benefit of TRACE lies in knowing that they are not being raked over the coals."

While we are unaware of any study examining the effect of dissemination in the context of bankruptcy, anecdotal evidence suggests that dissemination plays an important role in Chapter 11 as well. For example, in his testimony before the American Bankruptcy Institute's Chapter 11 Reform Commission, Edward I. Altman notes that: "All parties involved can now continuously and clearly observe the market's assessment of the debtor's liabilities so as to determine whether to sell or retain their interests and those prices provide important benchmarks for negotiating... [E]nhanced price discovery, compared to pre-1990 experience, helped to provide a more liquid market for the debt as the debtor works its way through the restructuring."[7]

[7]While we have no systematic evidence on whether bankruptcy courts rely on market prices when determining the enterprise values of individual debtors, anecdotal evidence suggests that some courts pay attention to market prices. For example, in VFB LLC v. Campbell Soup Co., 482 F.3d 624 (3d Cir. 2007), the court accepted a valuation analysis based on market prices and explained that: "Absent some reason to distrust it, the market price is a more reliable measure of ... value than the subjective estimates of one or two expert witnesses." Similarly, in TOUSA, Inc., 422 B.R. 783 (Bankr. S.D. Fla. 2009), the court agreed to using market values of publicly traded debt and equity to calculate enterprise value and explained that "... the sum of the market values of a company's debt and equity is the textbook definition of enterprise value... [I]t is commonly accepted among valuation professionals... [T]he market price of the equity plus the market price of the debt is what it would cost investors to purchase claims on all of the company's assets." Moreover, in Iridium Operating LLC, 373 B.R. 283 (Bankr. S.D.N.Y. 2007), the court explained that "... the public trading market constitutes an impartial gauge of investor confidence and remains the best and most unbiased measure of fair market value and, when available to the court, is the preferred standard of valuation." The court noted that it would need "...a substantial reason to depart from that standard ... that the value implied

In our empirical analysis, we use the enhanced TRACE data set (released by FINRA in March 2010) that includes both disseminated and non-disseminated historical bond transactions starting from TRACE's initiation in July 2002. This data set allows us to compare, at a given point in time, court misvaluations for two groups of companies with publicly traded bonds, those with disseminated bond prices, and those without. Overall, using a sample of 52 firms with publicly traded bonds during the Chapter 11 process, we find that the average court misvaluation is 37% in the dissemination sample and 67% (almost twice as high) in the non-dissemination sample; the difference is statistically significant at the 1% level.[8] When we control for observable factors correlated with the timing and likelihood of TRACE dissemination as well as the difficulty of valuing the debtor, we find that the difference between the two samples remains economically large and statistically significant. Finally, to ensure that outliers do not drive our results, we also estimate linear probability regressions examining the likelihood of large (i.e., above sample median) misvaluations and find that large misvaluations are between 44% and 68% less likely for firms whose bond prices were disclosed via TRACE.

While we find that misvaluations are reduced by public availability of bond prices, other indicators of firm value may (partially) substitute for bond prices. Indeed, we find that the reduction of court valuation errors due to TRACE disclosure is substantially greater for firms with fewer available market-based indicators of value; dissemination reduces valuation errors significantly more for smaller firms, firms covered by fewer stock analysts, and firms that were not subject to acquisition bids during Chapter 11. Moreover, we find that dissemination matters significantly less in bankruptcies where vulture funds obtain significant equity stakes in the reorganized company. This is consistent with the evidence in Jiang et al. (2012) that the presence of hedge funds as unsecured creditors reduces distortions arising from conflicts of interest between the debtor and secured creditors. While Gilson et al. (2000) find that the presence of vulture funds in the unsecured creditor class influences the court plan to systematically overvalue the firm, our results go further and find that the presence of vulture funds reduces significantly the size of misvaluations.

by an efficient market is not a trustworthy benchmark." Not all bankruptcy judges agree, however. For example, in Exide Techs., 303 B.R. 48 (Bankr. D. Del. 2003) and Mirant Corp., 331 B.R. 800 (Bankr. N.D. Tex. 2005), the courts refused valuations based on market prices and noted that the taint of a bankruptcy reduces the usefulness of post-petition trading prices of a debtor's securities as an indication of value, because markets tend to undervalue entities in bankruptcy.

[8] Since the misvaluations include only part of the newly issued securities, the misvaluation of the enterprise value is significantly smaller (XX).

We provide an additional test to examine the effect of TRACE dissemination. We compare average court misvaluations for firms with and without publicly traded bonds before and after TRACE dissemination, using an empirical strategy which is in the spirit of a difference-in-differences (DID) analysis. In this test, the period before the full implementation of TRACE serves as our pre-treatment period and the period after serves as our post-treatment period. Our pre-treatment sample includes only firms with registered bonds without disseminated prices and firms without any outstanding bonds. Our post-treatment sample consists of firms with registered bonds where prices are disseminated and firms without outstanding bonds. We find that, before TRACE, firms with publicly traded bonds (whose prices were not disseminated) had similar court misvaluations to those firms with no outstanding bonds. After TRACE, the average misvaluation of firms without bonds was much larger than the average misvaluation of firms with bonds whose prices were publicly disseminated. We estimate that bond price dissemination reduces court misvaluations by approximately 50%.

Misvaluations are more significant if they lead to wealth transfers between different claimants—a sentiment echoed by Baird and Bernstein (2006)'s assertion that the uncertainty in the valuation of the debtor in Chapter 11 bankruptcy proceedings presents a significant challenge in maintaining the priority structure of both debt and equity claims upon emergence from Chapter 11. We estimate that dissemination of bond transactions via TRACE reduces the frequency and average size (relative to market value of newly-issued common stocks on emergence) of unintended inter-claimant wealth transfers. In particular, we find that dissemination reduces the likelihood of an inter-claimant wealth transfer by 27.8% (significant at the 5% level) from 36.8% to 9.1%. Also, while the average size of inter-claimant wealth transfers in the disclosure sample is a mere 2.2%, the average size of transfers in the non-disclosure sample is 25.7%. The difference between the two groups is statistically significant at the 1% level and economically large. Overall, the evidence suggests that availability of bond prices reduces the likelihood and size of unintended inter-claimant wealth transfers and consequent deviations from APR.

The paper makes three contributions to the literature. The principal contribution is that it provides an experiment examining how dissemination of market prices of bonds affects the accuracy of court valuations in Chapter 11. The results unequivocally show that dissemination significantly reduces court misvaluations, especially where alternative indicators of firm value are unavailable.

The paper also examines the effect of misvaluations on wealth transfers between different claimants; while dissemination halves the size of misvaluations, it virtually eliminates wealth transfers between different claimants. Finally, the paper examines the role of hedge fund positions in fulcrum securities and its impact on the size of misvaluations and wealth transfers between different claimants. The paper closest to ours is the one by Gilson et al. (2000) which measures the size of misvaluations based upon management cash flow projections and the market value of securities on emergence. They recognize the importance of market prices to court valuations, but they provide no systematic evidence to show their causal impact as in our TRACE experiment. They also examine the impact of hedge funds on misvaluation and show that when hedge funds are junior creditors [and receive equity] the courts put a higher valuation on the debtor. We find the same result, but in addition, we also find that the presence of hedge funds sharply reduces the size of court misvaluations and the wealth transfers between different claimants.

The insights of this paper may be relevant beyond the Chapter 11 setting, for example, to EU bank resolution procedures, where haircuts of particular securities (such as bail-in bonds) are based upon hypothetical valuations of the reorganized banks. Our results also have important asset pricing implications. In particular, even if court valuations are unbiased estimates of the true reorganization value (see Gilson et al. (2000)), the reduction in valuation uncertainty and unintended inter-claimant wealth transfers due to dissemination will reduce the option value of default and therefore reduce the offered yields on bonds.

The rest of the paper is organized as follows. Section 2 provides a brief overview of institutional background on dissemination of corporate bond transactions via TRACE. Section 3 presents our empirical design. Section 4 describes the data sources and estimation samples. Sections 5 and 6 present the estimated effect of TRACE disclosure on court misvaluations. Finally, Section 7 concludes.

2. TRACE Dissemination of Bond Transactions

Trade Reporting and Compliance Engine (TRACE)) was introduced by the National Association of Securities Dealers (NASD) on July 1, 2002 in an attempt to enhance price transparency and integrity in the over-the-counter (OTC) secondary corporate debt and other markets in fixed income

securities. The system assembles all OTC bond transactions facilitated by brokers and dealers registered with the NASD and it publicly disseminates those transactions in real time. Most U.S. dollar-denominated corporate debt securities registered with the Securities and Exchange Commission (SEC) are TRACE-eligible.

As Asquith et al. (2013) explain, TRACE has replaced a preexisting platform, the Fixed Income Pricing System (FIPS) that was initiated in 1994. Before TRACE, NASD was using the FIPS platform to distribute transaction data for approximately 50 high yield bonds. In the late 1990s, the SEC requested NASD to take steps to increase the transparency of the corporate debt markets. The idea, as explained by Asquith et al. (2013), was to (i) create a platform to assemble and disseminate information on all secondary market corporate bond trades, (ii) create a database of corporate bond transactions that would allow regulators to supervise the market activity, and (iii) establish a surveillance system that would enable detection of misconduct and enhance investor confidence.

TRACE collected bond data from inception in July 2002; however, instead of disseminating price and volume data for all reported bond trades to public investors, NASD implemented the dissemination in phases. This allowed NASD to examine the impact of transparency on bond liquidity before introducing dissemination for high yield securities whose liquidity could be relatively more sensitive to changes in transaction transparency. Phase 1 implemented on July 1, 2002 involved dissemination of information for large (i.e., original issue size $1 billion or greater) investment grade bonds as well as 50 non-investment grade bonds that were disseminated under FIPS. In the first phase, NASD disseminated transaction information for approximately 520 bonds that satisfied the criteria for selection. Phase 2, initiated on March 3, 2003 and became fully implemented on April 14, 2003, expanded dissemination to include smaller investment grade bonds (i.e., original issue size between $100 million and $1 billion). By the time the second phase was completed, the number of disseminated bonds increased to 4,650. Finally, phase 3, initiated on April 22, 2004, expanded dissemination to almost all corporate bonds. This last phase was completed on February 7, 2005 when real time transaction and price data for 99% of corporate bond trades had become publicly available.[9]

[9]For additional details on the TRACE, see Trace Fact Book 2005 at: https://www.finra.org/sites/default/files/AppSupportDoc/p017618.pdf

In March 2010, FINRA released a data set, which includes both disseminated and non-disseminated historical bond transactions between July 1, 2002 and February 7, 2005. This data set allows us to collect prices of bonds which were not available at the time of transaction and during the Chapter 11 proceedings. As a consequence, it allows us to measure court misvaluations for the two groups of companies with TRACE-eligible bonds, those with disseminated bond prices, and those without.

3. Empirical Design

Determining the impact of publicly available bond prices on court misvaluation appears to be a simple empirical exercise: construct a measure of misvaluation and estimate a regression to examine the sensitivity of misvaluation to the existence of publicly disclosed bond prices. However, potential selection issues hamper any causal interpretation of this regression. In particular, firms with publicly available pricing information might be endowed with other characteristics that improve (or reduce) the court's ability to properly value the defaulted company, biasing the estimated coefficient of disclosure. Thus, we need an identification strategy to estimate the causal impact of bond price dissemination on court misvaluation. We employ two distinct empirical strategies to overcome the identification challenge, as discussed below.

3.1. Staggered Disclosure Design

The staggered implementation of TRACE dissemination provides our first series of tests. We identify companies with at least one registered bond that traded during the bankruptcy process and divide those companies into two groups based on whether their bond prices were publicly disseminated. As long as the dissemination decision is exogenous to the determination of plan value, the regression specified in Equation (1) appropriately identifies for this sample of firms the incremental impact of disclosure of bond prices on the misvaluation attached to newly-issued common stocks in the plan of reorganization.

$$MisVal_i = \alpha + \beta_1 Disclosed_i + \epsilon_i \tag{1}$$

Here, $MisVal_i$ is the absolute difference between the plan value and post-emergence market value of newly-issued common stocks, all divided by the average of the two values. We discuss this

measure in greater detail in Section 4. *Disclosed* is an indicator variable that equals one if the the company had at least one bond whose prices were publicly disseminated via TRACE during Chapter 11.

One potential concern with Equation (1) is selection—firms with and without disclosure may be different in terms of characteristics that are related to the ease of accurately valuing a company in court. However, TRACE dissemination was based on a set of observable factors, primarily bond rating and liquidity. Thus, conditional on bond rating and liquidity, dissemination is likely to be independent of the difficulty in valuing the firm.

The equation below includes a vector of control variables to account for the observable selection effects on dissemination:

$$MisVal_i = \alpha + \beta_1 Disclosed_i + \gamma \mathbf{X} + \epsilon_i \tag{2}$$

Equation (2) includes key set of control variables that were used by NASD to determine the timing of TRACE dissemination, namely credit rating, bond liquidity, year of bankruptcy filing (or emergence), and plan duration. We also include an additional set of regressors, firm size, leverage, equity volatility, leverage, and analyst coverage, that might impact the ability of courts to accurately estimate the true value of a defaulted company's assets. Conditional on these control variables, we expect β_1 to reflect the causal impact of dissemination on court misvaluation.

We also examine whether availability of alternative market-based indicators of firm value partially substitute for the availability of bond prices. In particular, we examine whether the effect of TRACE disclosure on court misvaluation is lower for bigger firms and firms with more analyst coverage by interacting the disclosed dummy with firm size and number of stock analysts that cover the firm.

3.2. Difference-in-Differences Approach

Our second set of empirical tests are in the spirit of a difference-in-differences (DID) analysis. The idea is that TRACE dissemination should affect only those firms with registered bonds; firms that only have bank debt or unregistered bonds in their capital structures should be unaffected

by the introduction of TRACE disclosure.[10] We use April 22, 2004 (when the third and final phase of TRACE dissemination began) to divide our sample into pre-TRACE and post-TRACE periods. Firms that emerge from Chapter 11 before (after) this date are included in our pre-TRACE (post-TRACE) sample. Our pre-TRACE sample includes only firms with registered bonds without disseminated bond prices and firms without any outstanding bonds. Our post-TRACE sample consists of firms with registered bonds where bond prices are disseminated and firms without outstanding bonds. We estimate the impact of dissemination on court misvaluations by calculating average misvaluations separately for firms with and without registered bonds both in the pre-TRACE and post-TRACE periods, and examine whether the average court misvaluation declines more for firms with registered bonds relative to firms without registered bonds after dissemination.

The DID approach uses the following regression specification:

$$MisVal_i = \alpha + \beta_1 Registered\ bonds_i + \beta_2 Post_i + \beta_3 Registered\ bonds_i \times Post_i + \gamma \mathbf{X} + \epsilon_i \quad (3)$$

Registered bonds is an indicator variable that equals one if the firm has SEC registered bonds that traded publicly during the bankruptcy process. *Post* is an indicator variable that equals one if the firm emerges from Chapter 11 after April 22, 2004. Finally, *Registered bonds* $\times$ *Post* is the interaction of the two indicator variables.

Here, β_1 captures the difference in average court misvaluation for firms with and without outstanding TRACEable bonds during the pre-TRACE period. β_2 represents the change in the average misvaluation for firms without registered bonds from the pre-TRACE to the post-TRACE period. Finally, β_3 is the main coefficient of interest in the DID design. It measures the difference between firms with registered bonds and firms without registered bonds in terms of the change in average misvaluation in response to the implementation of TRACE. A negative (positive) coefficient implies that, when dissemination is introduced, firms with registered bonds experience a greater reduction (increase) in court misvaluation than firms without registered bonds.

[10] Since our estimation sample is cross-sectional, we observe one court misvaluation per firm instead of observing misvaluations for the same firm both before and after the treatment, as in classical DID analyses based on longitudinal data.

4. The Sample and Data

We obtain data on publicly traded US firms that filed for Chapter 11 bankruptcy protection from the UCLA-LoPucki Bankruptcy Research Database (BRD). We focus on bankruptcies that satisfy the following criteria: (1) the firm files for Chapter 11 on or after January 1, 2001 and emerges from Chapter 11 as an independent publicly traded company prior to December 31, 2010; (2) information on pre-petition firm financial characteristics is available from Compustat fundamentals annual files; (3) information on the common stock prices of the firm in the year after emergence from Chapter 11 is available through either Compustat daily security files or CRSP daily stock files; (4) court valuation of newly-issued common stocks under the Chapter 11 plan of reorganization is available from the disclosure statement for the final confirmed reorganization plan or the first post-emergence 10-K filing of the company on EDGAR.

Using the remaining reorganizations, we construct two different samples. The first sample, used in our quasi-experimental analysis, consists of 52 Chapter 11 reorganizations of firms whose bonds were publicly traded during the Chapter 11 process. This sample is restricted to firms that emerge from Chapter 11 after the introduction of TRACE in July 1, 2002. Our source of bond trading information is the TRACE-enhanced database that includes both disseminated and non-disseminated historical corporate bond transactions since July 1, 2002. Using this database, we identified 33 reorganizations where the prices of the debtor's bonds were publicly disseminated during the bankruptcy process. In 27 of those cases dissemination was initiated before the bankruptcy filing and in the remaining 6 cases dissemination was initiated during the bankruptcy process.[11] In the remaining 19 cases, transactions in the debtor's bonds were recorded but were not publicly disseminated by TRACE—those transactions eventually became publicly available with the release, in March 2010, of the TRACE-enhance database that includes historical bond transactions.

The second sample, used in our DID analysis, includes reorganizations of firms both with and without publicly traded bonds. This sample includes 45 of the 52 reorganizations in the sample used in our quasi-experimental analysis in addition to 36 reorganizations of firms without publicly traded bonds in their capital structures. Seven firms with publicly traded bonds are not included in this sample, because they emerged from Chapter 11 on or before February 14, 2005 (the last

[11] Dissemination was initiated during Phase 1 of TRACE dissemination in 8 cases, during Phase 2 in 5 cases, during Phase 3 in 13 cases, and after the full implementation of TRACE in 7 cases.

day of the TRACE implementation window as well as the pre-treatment period) and transactions on their bonds were being disclosed via TRACE prior to the emergence date.

We measure court valuation errors using the following formula:

$$MisVal = \frac{|V_{court} - V_{market}|}{[(V_{court} + V_{market})/2]} \tag{4}$$

Here, V_{court} is the court-determined value of the reorganized company's newly-issued common stock. V_{market} is the average split- and issuance-adjusted market value of the stocks one calendar year after emergence from Chapter 11, discounted back to the emergence date using the return on the daily CRSP equal-weighted stock index over the same time horizon. When calculating $MisVal$, we do not rely on market values immediately after emergence from Chapter 11 since practitioners suggest that stock prices may be temporarily depressed after emergence due to selling pressures (see Gilson et al. (2000)). We normalize the absolute difference between V_{court} and V_{market} by the average of the two values (i) to bound our measure of misvaluation between zero and two, thus reducing the potential effect of outliers on our results; and (ii) to treat equally overvaluations and undervaluations associated with court vs. market value pairs.[12]

To examine whether misvaluation leads to deviations from strict absolute priority, we also collect information on the size (also referred to as the "allowed amount" in court documents) of each claim class as well as court-determined total values of cash, notes, and equity securities distributed to those classes in the final plan of reorganization. We distinguish between intended and unintended deviations from strict absolute priority. An intended deviation occurs when, in the plan of reorganization, a junior claim class receives distributions before the senior classes are fully paid off. In other words, intended deviations are wealth transfers from senior claimants to junior claimants as part of a consensual plan of reorganization. An unintended absolute priority deviation occurs when court undervaluation (overvaluation) of the newly-issued common stocks results in wealth transfers from junior to senior (senior to junior) claimants.

For example, consider a hypothetical Chapter 11 reorganization where both senior creditors and junior creditors both have allowed claims of \$100. Suppose, for simplicity, that the bankruptcy

[12]The second point is best illustrated with an example. Suppose Firm A has a court value of \$40 million and market value of \$60 million, and Firm B has a court value of \$60 million and market value of \$40 million. Misvaluation, based on our measure, is 40% in both cases. Using instead the plan value in the denominator would lead to misvaluations of 50% and 33% for Firm A and Firm B, respectively.

court only distributes newly-issued common stocks to claimants (no cash, notes, or warrants are distributed). Suppose also that the court values the stocks at $125, and distributes 80% of the stocks to senior creditors, resulting in a 100% recovery rate for senior creditors. The remaining 20% of the stocks, after senior creditors are fully paid off, are distributed to junior claimants, consistent with the strict absolute priority rule. Suppose, however, that market participants value the stocks at $80 upon emergence from Chapter 11, indicating that the court significantly overvalued the stocks. Based on market values, senior creditors recover 64% and junior creditors recover 16% of their allowed claims, reflecting a violation of the strict absolute priority rule, since junior claimants received payments before senior claimants are fully paid off. The size of the court valuation error in this example is $45 (or 43.9% based on our misvaluation measure) and the size of wealth transfer from senior creditors to junior creditors due to court misvaluation is $16. In our empirical analysis, we scale the dollar amount of the wealth transfer (in absolute value) by the total market value of newly-issued common equity on the emergence date. Therefore, the size of unintended inter-claimant wealth transfer in the example is 20%.[13]

More generally, when calculating the size of unintended inter-claimant wealth transfers, we assume that no claimant's recovery can exceed 100%. When the court value exceeds (is less than) the post-emergence market value, we allocate the reduction (increase) in reorganization value in ascending (descending) priority order. We hold distributions of cash and notes constant and focus only on the distributional effects of common stock misvaluations. Note that court misvaluations do not always result in wealth transfers among claimants. For example, in the example above, had market participants valued the company's stocks at $150 on emergence (resulting in a $25 court undervaluation), there would have been no wealth transfer between junior creditors and senior creditors.

[13]Inter-claimant wealth transfers may also arise from court *undervaluation* of the newly-issued stocks. For example, in the hypothetical reorganization above, suppose the court values the new shares at $80, distributes all the new shares to senior creditors consistent with strict absolute priority (based on plan values), but upon emergence from bankruptcy market participants value the shares at $125. This would result in a $25 million wealth transfer from junior creditors to senior creditors based on market values (an unintended inter-claimant wealth transfer of 20% based on our measure).

5. Quasi-Experimental Analysis

5.1. Univariate Results

Table 1 displays summary statistics for the sample of 52 Chapter 11 reorganizations used in our quasi-experimental analysis. In the table, we present the mean value of each variable separately for the (i) "overall sample" which consists of the reorganizations of all 52 firms with publicly traded bonds in their capital structures (column (1)), (ii) "disclosure sub-sample" which consists of 33 reorganizations of firms whose bond prices were disseminated during the Chapter 11 process (column (2)), and the (iii) "non-disclosure sub-sample" which consists of 19 reorganizations where the debtor's bond prices were not disseminated (column (3)). We also present the results of two sample t-tests (based on pooled variances) that we use to examine the hypotheses that the population means are equal for the disclosure sample and the non-disclosure sample (column (4)).

Panel A displays summary statistics on the size of court misvaluations. As shown, in our overall sample, the average misvaluation is 47.7%, similar to the average misvaluation of 44.7% in Butler (2003)'s sample of 97 Chapter 11 reorganizations during 1990-1997 of firms both with and without publicly traded bonds. In roughly two thirds of the reorganizations in our overall sample misvaluation exceeds 25%, and in roughly one fifth of the reorganizations it exceeds 100%. Such large valuation errors raise significant concerns about the distributional efficiency of the Chapter 11 process (see, e.g., Bebchuk (1988, 2002)). We examine the distributional consequences of court misvaluations in detail below.

Our main focus in Panel A is to test the hypothesis that the dissemination of bond prices during the Chapter 11 process reduces the average size of court misvaluations. Consistent with this hypothesis, we find that the average misvaluation of the disclosure sub-sample is a little more than half (36.6%) of that of the non-disclosure sub-sample (67.0%). This difference does not arise from outliers in the data: The difference between the median court misvaluation of the disclosure sub-sample (26.5%) and that of the non-disclosure sub-sample (60.8%) is also economically substantial (34.3%) and statistically significant (p=0.027) (not tabulated). In addition, relative to the non-disclosure sample, the disclosure sample has a substantially higher frequency of reorganizations with misvaluations below 25% (45.5% vs. 21.1%) and a significantly lower frequency of reorganizations with misvaluations above 100% (9.1% vs. 31.6%).

To provide a basis of comparison for our results we construct a synthetic misvaluation measure for publicly traded equities. As detailed in Section 4 we obtain V_{court} directly from the disclosure documents or emerging 10k, and V_{market} by averaging the risk and issuance adjusted market value of firms for each month subsequent to emergence for the following year. We generate a synthetic misvaluation measure for non-defaulted securities by assuming that the market value on the 31st of December reflects the "plan valuation" ($V_{court}^{synthetic}$) and the average risk and issuance adjusted market value in each month up to December 31st represents the synthetic "market value" ($V_{market}^{synthetic}$). Using these synthetic measures for all firms trading on the NYSE, AMEX, or NASDAQ exchanges and which have a market price of over \$5 on December 31st we calculate $MisVal^{synthetic}$. We find that the synthetic misvaluation measure is between 28% and 37% depending on risk adjustment techniques. This compares to the 37% average misvaluation in our disclosure sample; courts in the disclosure sample are not significantly worse at predicting future equity value in the than the market.

Dissemination reduces not just the average court misvaluation but also the standard deviation of court misvaluations. In particular, we find that the standard deviation of court misvaluations is significantly lower (p=0.046) in the disclosure sub-sample (36.3%) than in the non-disclosure sub-sample (45.9%) (not tabulated), suggesting that dissemination significantly improves the predictability of court (mis)valuations. Taken together, these results imply that disclosure decreases the expected probability and size of misvaluations. Such improvements in the accuracy of court hypothetical valuations directly influence the possibility of unintended wealth transfers between claimants in reorganization and therefore likely affect the ex-ante cost of capital for firms.

Panel B presents evidence on inter-claimant wealth transfers. We distinguish between intended and unintended wealth transfers and report both the frequency and the average size of those transfers in the table. As shown, while we find no significant difference in the frequencies of intended and unintended deviations from the absolute priority rule (APR) (17.3% and 19.2%, respectively) in our overall sample, we find that unintended APR violations result in substantially bigger inter-claimant wealth transfers than the intended violations in the court plan of reorganizations (10.8% vs. 0.5%, respectively). The evidence suggests that misvaluations result in substantial inter-claimant wealth transfers in US Chapter 11 proceedings, whereas those incorporated in the plan of

reorganization are trivially small.[14]

As shown in Panel B, we find no difference between the disclosure sub-sample and the non-disclosure sub-sample in terms of the frequency and size of intended deviations from APR. However, we find that unintended deviations from APR are significantly less common (p=0.014) in the disclosure sub-sample (9.1%) than in the non-disclosure sub-sample (36.8%). Moreover, we find that the average size of inter-claimant-wealth transfers in unintended APR violations is significantly smaller (p=0.007) in the disclosure sample (2.2% vs. 25.7%). While the size of misvaluations in the disclosure sample remains significant, the consequent wealth transfers between different claimants is tiny. In contrast, wealth transfers for the non-disclosure sample remain very large indeed.

To summarize, the univariate evidence in Table 1 provides strong support for the hypothesis that dissemination of bond prices reduces average court misvaluations as well as the size and the frequency of consequent unintended deviations from APR. In the next three subsections, we conduct multivariate tests to examine the robustness of these univariate findings. However, before turning to the multivariate tests, we examine whether there are systematic differences between the disclosure sample and the non-disclosure sub-sample based on bankruptcy and firm characteristics. As shown in Panel C and D of Table 1, we find that firms in the disclosure sub-sample are on average bigger, they are followed by more stock analysts, and they have higher bond liquidity than firms in the non-disclosure sample. We also find that firms in the disclosure sample are significantly more likely to file for Chapter 11 in Delaware or New York Southern District bankruptcy courts where the Chapter 11 process is faster. In our regressions, we control for these factors to identify the incremental effect of dissemination on court misvaluations and inter-claimant wealth transfers.

5.2. Base Regression Results

As discussed in Section 3.1, the introduction of TRACE provides a quasi-natural experiment to identify the effect of bond price transparency on court valuation accuracy. Our hypothesis is that dissemination reduces the size of court misvaluations. We test this hypothesis using Equation (1), a univariate regression specification, and Equation (2), a multivariate regression specification that

[14]In comparison, Ayotte and Morrison (2009) find evidence of APR violations in 12% of the large Chapter 11 reorganizations in 2001, whereas Bharath, Panchapagesan, and Werner (2014) document APR violations in 13% of the reorganizations during the first half of the 2000s. Bharath et al. (2014) find an average wealth transfer of 0.44% of firm value in the same period. Note that Ayotte and Morrison (2009) and Bharath et al. (2014) focus only on APR violations in favor of pre-petition equityholders and conflate intended and unintended violations.

controls for factors that are correlated with both the likelihood of dissemination and the severity of valuation uncertainty. The results are presented in Table 2.

Column (1) presents the estimates from Equation (1) where the dependent variable is misvaluation, the intercept shows the average misvaluation for the undisclosed group, and the coefficient of *Disclosed* dummy shows the estimated impact of disclosure on average court misvaluation. The estimates from this model are identical to the estimates based on mean comparison tests reported in Panel A of Table 1 and serve as baselines for our multivariate tests. As shown, before controlling for factors that may be correlated with both disclosure and misvaluation, dissemination substantially reduces court misvaluations by 30.4% (significant at the 5% level).

The dissemination dummy is correlated with the timing of the firm's bankruptcy reorganization. This is because our non-disclosure sub-sample consists of firms that emerge from Chapter 11 before TRACE dissemination was expanded to the universe of corporate firms in February 2005, whereas our disclosure sub-sample consists of firms that emerge from bankruptcy in any year during 2002 through 2010. If the year a firm enters into bankruptcy or emerges from bankruptcy is also correlated with the difficulty of valuing the firm (for example, due to variation in the busyness of bankruptcy courts (Iverson (2015)) or the nature of firms that reorganize), the specification presented in column (1) will suffer from an omitted variables bias. To address this concern, we estimate regressions with emergence year and filing year dummies, as shown in columns (2) and (3), and find that dissemination reduces court misvaluations by 52.4% and 46.7%, respectively (both estimates are statistically significant at the 1% level).[15] Compared to the baseline estimate reported in column (1), the estimated effect of disclosure based on models with year dummies is roughly 20% bigger (in absolute value).

As discussed in Section 2, during the TRACE implementation window, dissemination began earlier for large, highly rated, and actively traded bonds, and later for smaller, high yield, less

[15] In regressions with year fixed effects, identification of the coefficient estimate for the dissemination dummy comes from observations in years where there is some cross-sectional variation in dissemination. For example, calendar years 2003 and 2004 are the only years during our sample period in which some firms from both our disclosure sample and our non-disclosure sample emerged from bankruptcy: All the firms that emerged from Chapter 11 in calendar year 2002 are in our non-disclosure sample and all the firms that emerged during 2005-2010 are in our disclosure sample. As a result, in the model with emergence year dummies, identification of the coefficient for *Disclosure* comes from reorganizations completed in 2003 and 2004. 18 of our sample firms emerged from bankruptcy in 2003 or 2004. Six of those firms are in our disclosure sample and 12 are in our non-disclosure sample. Similarly, identification in the model with filing year fixed effects comes from the sub-sample of reorganizations that began in calendar years 2001, 2003, and 2004. Out of the 21 firms that filed for Chapter 11 in 2001, 2003, or 2004, 11 firms are in our disclosure sample and 10 firms are in our non-disclosure sample.

liquid bonds. As a result, for firms that emerge from Chapter 11 before the full implementation of TRACE, whether the firm is included in our disclosure sub-sample or our non-disclosure sub-sample is determined by the characteristics of the firm's outstanding bonds (at the time dissemination decisions were made by NASD, and not at the time the court determined the firm's valuation). If those characteristics are also correlated with the difficulty of valuing the firm, dissemination could just serve as a proxy for omitted bond characteristics instead of having a causal impact on the size of court misvaluations. One way to address this concern is to control for the characteristics of the debtor's bonds in our regression models. However, NASD has not publicly disclosed how exactly it measured those characteristics and formulated its final dissemination decisions. More important, it is not obvious which time interval is most appropriate for measuring the liquidity and the credit rating of a debtor's bonds.

To overcome these empirical challenges, we employ an alternative estimation strategy.[16] In particular, we estimate a model where we substitute the disclosure dummy used in columns (1) to (3) with four dummy variables that indicate the phase in which the firm's bonds were publicly disseminated for the first time (the fourth dummy indicates that the dissemination was initiated after February 7, 2005). The idea here is to separate the causal effect of dissemination on court misvaluation from the effect of omitted bond characteristics, by comparing the coefficients of the dissemination phase dummies. For example, because bonds disseminated in Phase 1 and Phase 3 have different characteristics, differences in the coefficients of the Phase 1 and Phase 3 dummies in our model will reflect the effect of those omitted bond characteristics on court misvaluations. If dissemination is indeed a proxy for omitted bond characteristics correlated with the difficulty of valuing a company, we would expect to find the coefficients of the dummy variables to be significantly different from one another. However, as shown in column (4) of Table 2, the coefficients of all four dummy variables are similar in magnitude; three of them are statistically significant at conventional significance levels, and the fourth coefficient (the coefficient of the Phase 2 dummy), while not significant, has a t-statistic of 1.50. More important, when we formally test, for each pair

[16]Though not tabulated, we estimated a model where we controlled for bond size (defined as the natural logarithm of the bond's par value at origination), bond liquidity (defined as the maximum quarterly average value of the percentage of days traded between July 1, 2002 and the date of emergence from Chapter 11), and bond rating (defined as the natural logarithm of the highest numerical bond rating for the firm between July 1, 2002 and the emergence date). Overall, we find that none of the bond characteristics is significantly related to the size of court misvaluation. Moreover, the size and significance of the disclosure dummy are not sensitive to the inclusion of the bond characteristics.

of disclosure dummies, whether their coefficients are equal, we fail to reject equality at conventional significance levels. Overall, the evidence suggests that the dissemination dummy is not simply a proxy for omitted bond characteristics, or in other words, dissemination has an effect on court misvaluations that is independent of bond characteristics.

Finally, in columns (5) to (7), we provide evidence that the estimated effect of dissemination on court misvaluation is robust to controlling for industry dummies, firm characteristics, and bankruptcy characteristics. We also show that court misvaluations are significantly greater in reorganizations of smaller firms and firms with higher valuation uncertainty (as measured by post-emergence stock return volatility).

We conduct two sets of tests to check the robustness of the results in Table 2. To conserve space, we present the results of those tests in the online appendix and briefly summarize them here. First, we substitute our dependent variable, misvaluation, with a binary dependent variable that takes a value of one if court misvaluation exceeds the median misvaluation over the sample period (32%); and zero otherwise. This binary variable emphasizes large deviations that presumably matter most for potential inter-claimant wealth transfers while eliminating the possibility that one or two outliers are driving our results. Overall, we find that the likelihood of a large misvaluation is between 40.5% and 52.3% less likely for firms whose bond prices were disseminated via TRACE during the Chapter 11 process. Second, we estimate all the regressions in Table 2 after re-calculating our misvaluation measure (i) using the market values of common stocks 1-month, 3-months, and 6-months after the emergence date; (ii) using a discount rate based on the Capital Asset Pricing Model (CAPM), Fama-French Three Factor Model (FF3), or Carhart's Four Factor Model (FF4); and (iii) discounting post-emergence market values to the plan confirmation date or the filing date of the disclosure statement. We find that the alternative measures of court misvaluation are very highly correlated and our results are not sensitive to which of the alternative measures we use.

To summarize, the evidence in Table 2 indicates that dissemination reduces court misvaluation by between 27.8% and 52.4% (depending on the specification), as compared to an average misvaluation of 67% in cases without dissemination. In the next subsection, we examine whether the reductions in court misvaluation result in reductions in the size and likelihood of inter-claimant wealth transfers.

5.3. Disclosure of Bond Prices and Unintended Deviations from Absolute Priority

As discussed in Section 4, court misvaluations will not always result in inter-claimant wealth transfers. For example, consider a hypothetical reorganization where a class of senior creditors with $100 million of allowed claims received common stocks in satisfaction of their claims. Suppose that the court valued the stocks at $50 million in the plan of reorganization, but the market value of the stocks on emergence was $80 million. In this case, the plan undervalues the common stocks by $30 million and underestimates the recovery rate to the senior claimants by 30%, but the valuation error does not result in a wealth transfer between the claimants of the debtor. Thus, while the results in Table 2 indicate that the dissemination of verifiable bond transaction information substantially reduces court misvaluations, this need not directly translate into improved allocative efficiency.

Table 3 presents our OLS estimates of the effect of dissemination on the size of unintended inter-claimant wealth transfers that arise from misvaluation of the common stocks distributed in the plan of reorganization. In our estimations, we use the same regression specifications as in Table 2. As shown, we find that dissemination reduces the wealth transfers by between 20% and 26% (significant at the 10% level in most specifications).[17]

Overall, the results in Tables 2 and 3 provide strong support for the hypothesis that the dissemination of bond prices during bankruptcy significantly improves the distributional efficiency of Chapter 11 reorganizations. This is an issue that we return to in the next subsection.

5.4. Cross-Sectional Variation in the Effect of Dissemination on Misvaluations

In this section, we examine whether the availability of alternative sources of market-based information on firm value reduces the size of court misvaluations in Chapter 11 and attenuates the effect of TRACE dissemination on the size of court misvaluations. Table 4 presents our findings. Our models include a dummy variable indicating whether or not the reorganized firm is in our disclosure sub-sample, an information measure, and the interaction of these two variables. The coefficient of the information measure shows how court misvaluation varies with this measure in our non-disclosure sub-sample. The coefficient of the interaction term shows how the effect of dissemination on court misvaluation varies with the information measure.

[17] Because of the low frequency of non-zero wealth transfers, to check the robustness of our findings, we also estimate left-censored Tobit models and find significant coefficients in all the specifications (not reported for brevity).

As shown in columns (1) to (3), conditional on non-disclosure, we find significantly higher court misvaluations in the reorganizations of smaller firms (based on total assets on the petition date), firms covered by fewer than three stock analysts, and firms that did not receive acquisition bids for part or all of their assets during the bankruptcy process. The evidence suggests that valuation uncertainty arising from the lack of information significantly increases the size of court misvaluations in Chapter 11. We also find that TRACE disclosure reduces court misvaluations significantly more for the same groups of firms, suggesting that dissemination is most effective in reducing court misvaluations where alternative market-based indicators of firm value are limited or unavailable.

In column (4), we examine whether hedge funds help reduce distributional inefficiencies in Chapter 11 by reducing court misvaluations and whether their presence serve as a substitute for dissemination. This analysis is motivated by the evidence in Jiang et al. (2012) and Lim (2015) that hedge funds balance the power between senior and junior claimants and thereby reduce inefficiencies in the Chapter 11 process. Overall, we find that the presence of hedge funds is associated with a 63.2% lower misvaluation (significant at the 1% level) in the non-disclosure sub-sample, consistent with hedge funds improving the distributional efficiency of distressed reorganizations.[18] We also find that dissemination significantly reduces court misvaluations only where hedge funds are not present, suggesting that the presence of hedge funds and dissemination are substitutes in reducing court misvaluations.[19]

Finally, we examine whether dissemination has a greater effect on court misvaluations where the debtor's bonds are not actively traded in the market during the Chapter 11 process. We consider a bond as actively traded if the bond is traded in 80% or more of the trading days during the last three months of the bankruptcy process. As shown in column (5), for firms in our non-disclosure sample, we find that higher bond liquidity is associated with a 56% lower court misvaluations (significant at the 1% level), suggesting that, even when not publicly disseminated, prices of actively traded bonds may be helpful in reducing court misvaluations. We also find that dissemination reduces court misvaluations more where the debtor's bonds are less liquid, suggesting that the benefits of dissemination are greater where uncertainties regarding fair bond prices are higher.

[18]The estimated relation between hedge fund involvement and misvaluation might not be causal if hedge funds choose to invest in the unsecured claims of firms with lower valuation uncertainty.

[19]We find no evidence that dissemination reduces the likelihood of hedge fund participation.

Overall, the results in Table 4 are consistent with the conjecture that the incremental benefit of disseminating bond prices in terms of reducing uncertainty in bankruptcy valuations is greatest when there is less information about the valuation of the debtor.

6. Difference-in-Differences (DID) Approach

6.1. Univariate DID Results

As discussed in Section 3.2, our difference-in-differences (DID) approach is based on the idea dissemination of bond prices will affect court misvaluations for firms with TRACEable bonds, but not for firms without TRACEable bonds (e.g., firms that rely only on bank debt).[20] As explained before, we divide our sample period into pre-TRACE and post-TRACE periods based on the last day of TRACE implementation window (February 14, 2005). If a firm emerges from Chapter 11 before this date and had outstanding bonds with disseminated prices, we exclude the firm from our estimation (7 firms). Our DID sample consists of 81 reorganizations. 41 of those reorganizations were completed in the pre-TRACE period and 40 of them were completed in the post-TRACE period. Also, 45 firms in our DID sample had TRACEable bonds, whereas the remaining 36 firms did not.

We begin our DID analysis by examining univariate differences between reorganizations of firms with and without TRACEable bonds in both pre- and post-TRACE periods. As shown in Panel A of Table 5, we find that, in the pre-TRACE period, firms with registered bonds had 21% *higher* average court misvaluations than firms without registered bonds (not statistically significant). However, in the post-TRACE period, firms with registered bonds had 21% *lower* average court misvaluations than firms without registered bonds. Taken together, the evidence indicates that TRACE disclosure has reduced court misvaluations by roughly 42% (statistically significant at the 5% level).

As shown in Panel B, dissemination has also reduced the likelihood and the average size of unintended APR violations by 47% and 30%, respectively (both statistically significant at the 5% level). Overall, the univariate results in Panels A and B of Table 5 are consistent with the results of our quasi-experimental analysis: The dissemination of bond prices has a statistically significant and

[20] Ivashina, Iverson, and Smith (2016) find evidence that trading of debt claims during the Chapter 11 process increases debt concentration but does not increase the likelihood of successful a successful restructuring.

economically substantial negative effect on the size of court misvaluations as well as the likelihood and the size of consequent inter-claimant wealth transfers.

In Panel C and Panel D of Table 5, we provide comparisons of the average bankruptcy and firm characteristics of firms with and without TRACEable bonds both before and after TRACE. We find that the difference between firms with and without TRACEable bonds in terms of the likelihood of a prepackaged bankruptcy, the average duration of the bankruptcy process as well as average firm size, leverage, and profitability remained the same after TRACE dissemination. These results suggest that the reductions in court misvaluations and inter-claimant wealth transfers documented in Panels A and B are unlikely to arise from changes in sample composition in terms of bankruptcy and firm characteristics.

6.2. Multivariate DID Results

To check the robustness of the univariate results presented in Table 5, we estimate a set of DID regressions using Equation (3) and controlling separately for emergence year dummies, industry dummies, firm characteristics, and bankruptcy characteristics. The idea is to address the concern that differences in the observable characteristics of firms with and without registered bonds can explain the effect of dissemination on the size of misvaluations and wealth transfers reported in Table 5.

Our DID regression are displayed in Table 6. In Panel A, the dependent variable is the size of court misvaluation, while in Panel B, the dependent variable is the size of unintended wealth transfers between different claimants of the debtor. As shown in Panel A, the estimated reduction in the average size of court misvaluations due to TRACE dissemination does not appear very sensitive to the inclusion of control variables and ranges between 40% and 57% (statistically significant). Moreover, as shown in Panel B, dissemination significantly reduces the size of unintended wealth transfers by between 24% and 34%. It is noteworthy that the estimated economic magnitude of the dissemination effect in the DID analysis is similar to that found in the quasi-experimental analysis, even though the research designs and sample compositions in the two analyses are different.

Overall, the results in Table 6 are consistent with the hypothesis that the public dissemination of bond prices during the Chapter 11 process substantially reduces court misvaluations of reorganized companies and improves the distributional efficiency of Chapter 11 by substantially by reducing

the likelihood and the size of inter-claimant wealth transfers and consequent APR violations.

7. Conclusion

Our paper investigates how transparency of market prices can reduce court valuation errors in Chapter 11 bankruptcy. While the efficiency of market prices during default is controversial within the judiciary, we find that an increase in the availability of market prices results in a significant reduction in the size of court misvaluations in Chapter 11. In our analysis, we take advantage of the TRACE dissemination program which provides a plausibly exogenous shock to the transparency of transaction prices for defaulted firms. We find a very significant reduction, about 50%, in misvaluations for firms with disseminated bond prices, which largely eliminates wealth transfers between claimants and APR violations associated with valuation uncertainty. These findings strongly suggest that verifiable and transparent market prices act as a valuable source of information in Chapter 11.

Our paper has important policy implications in other settings where hypothetical valuations are used to determine asset recoveries such as in EU bank resolution procedures. Our results also have some important asset pricing implications. Even if court valuations are unbiased, the reduction in valuation uncertainty due to dissemination will reduce the option value of default in bond pricing and therefore reduce the offered returns on bonds.

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Table 1: Summary Statistics

This table displays summary statistics on the characteristics of 52 Chapter 11 reorganizations in our quasi-experimental sample. The reorganizations were completed between 2002 and 2010. All sample firms had outstanding bonds that were publicly traded during the firm's Chapter 11 process. Also, common stocks of all sample firms were publicly traded upon emergence from Chapter 11. Disclosure indicates that the firm's bond prices were publicly disseminated via TRACE during Chapter 11. Panel A presents summary statistics on court misvaluation of the reorganized firm's newly-issued common stocks. Panel B presents the frequency and average size of intended and unintended inter-claimant wealth transfers in sample reorganizations. Panel C and D provide average bankruptcy and firm characteristics, respectively. We use ***, **, and * to denote that the difference in the average values for the disclosure group and the non-disclosure group is significantly different from each other at the 1%, 5%, and 10% level, respectively.

Panel A. Average Misvaluations

	(1) Overall	(2) Disclosed	(3) Not Disclosed	(4) Difference [(2)-(3)]
Misvaluation (%)	47.7	36.6	67.0	−30.4**
Misvaluation (%) <25%	36.5	45.5	21.1	24.4*
Misvaluation (%) [25% to 50%)	26.9	30.3	21.1	9.3
Misvaluation (%) [50% to 100%]	19.2	15.2	26.3	−11.2
Misvaluation (%) >100%	17.3	9.1	31.6	−22.5**
Observations	52	33	19	52

Panel B. Absolute Priority Violations

	(1) Overall	(2) Disclosed	(3) Not Disclosed	(4) Difference [(2)-(3)]
100 x Intended violation (d)	17.3	15.2	21.1	−5.9
Avg. size of intended violation	0.5	0.6	0.3	0.3
100 x Unintended violation (d)	19.2	9.1	36.8	−27.8**
Avg. size of unintended violation	10.8	2.2	25.7	−23.5***
Observations	52	33	19	52

Panel C. Bankruptcy Characteristics

	(1) Overall	(2) Disclosed	(3) Not Disclosed	(4) Difference [(2)-(3)]
100 x Pre-packaged (d)	53.8	48.5	63.2	−14.7
Days in Chapter 11 (log)	5.6	5.7	5.4	0.3
100 x Creditors' committee (d)	90.4	93.9	84.2	9.7
100 x Equityholders' committee (d)	23.1	30.3	10.5	19.8
100 x Court: Delaware or New York S.D. (d)	80.8	90.9	63.2	27.8**
Observations	52	33	19	52

Panel D. Firm Characteristics

	(1) Overall	(2) Disclosed	(3) Not Disclosed	(4) Difference [(2)-(3)]
Assets (at filing, CPI adjusted) (log)	7.7	8.0	7.3	0.7**
Leverage ratio (at petition) (%)	110.3	106.3	117.2	−10.8
Stock volatility (post-emergence) (%)	16.2	16.5	15.7	0.8
Return on assets (pre-petition) (%)	5.6	6.7	3.6	3.0
100 x Analyst coverage (d)	32.7	48.5	5.3	43.2***
100 x Actively traded bonds (d)	28.8	42.4	5.3	37.2***
Observations	52	33	19	52

Table 2: Disclosure of Bond Prices and Court Misvaluation

We estimate ordinary least squares (OLS) regressions to examine the impact of public dissemination of bond transactions via Trade Reporting and Compliance Engine (TRACE) on court misvaluations. The sample is restricted to Chapter 11 reorganizations by firms with publicly traded bonds during the bankruptcy process and publicly traded common stock after emergence from Chapter 11. The table reports coefficients as well as t-statistics based on robust standard errors (in parentheses). We use ***, **, and * to denote that the estimated coefficient is significantly different from zero (two-tailed) at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Disclosed (d)	−30.43**	−52.36***	−46.73***		−30.77**	−27.79**	−25.03*
	(−2.49)	(−3.02)	(−2.91)		(−2.38)	(−2.48)	(−1.89)
Disclosure initiated in Phase 1 (d)				−42.07**			
				(−2.55)			
Disclosure initiated in Phase 2 (d)				−36.49			
				(−1.50)			
Disclosure initiated in Phase 3 (d)				−32.72**			
				(−2.05)			
Disclosure initiated after Phase 3 (d)				−39.21*			
				(−1.68)			
Emerged during TRACE implementation (d)				−8.25			
				(−0.64)			
Assets (at filing, CPI adjusted) (log)						−8.26**	
						(−2.23)	
Leverage ratio (at petition) (%)						−0.03	
						(−0.17)	
Return on assets (pre-petition) (%)						0.63	
						(0.96)	
Stock volatility (post-emergence) (%)						1.44*	
						(2.00)	
Pre-packaged (d)							17.97
							(1.48)
Creditors' committee (d)							−5.79
							(−0.28)
Equityholders' committee (d)							5.49
							(0.36)
DE or NY SD (d)							−11.83
							(−0.78)
Constant	67.01***	90.36**	62.99***	75.26***	61.63***	106.16***	67.43**
	(6.41)	(2.69)	(3.41)	(4.45)	(4.73)	(2.83)	(2.58)
Emergence year dummies	N	Y	N	N	N	N	N
File year dummies	N	N	Y	N	N	N	N
Industry dummies	N	N	N	N	Y	N	N
N	52	52	52	52	52	52	52
R^2	0.12	0.29	0.25	0.13	0.19	0.28	0.18

Table 3: Unintended Violations of APR

We estimate OLS regressions to estimate whether dissemination reduces the size of unintended APR violations, relative to the market value of newly-issued common stock on emergence. We use ***, **, and * to denote that the difference is significantly different from zero (two-tailed) at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Disclosed (d)	−23.52**	−26.10*	−21.81*		−25.15**	−20.96*	−14.93
	(−2.15)	(−1.96)	(−1.98)		(−2.25)	(−1.87)	(−1.46)
Disclosure initiated in Phase 1 (d)				−25.31**			
				(−2.17)			
Disclosure initiated in Phase 2 (d)				−28.95**			
				(−2.51)			
Disclosure initiated in Phase 3 (d)				−25.08**			
				(−2.19)			
Disclosure initiated after Phase 3 (d)				−29.76**			
				(−2.57)			
Emerged during TRACE implementation (d)				−4.06*			
				(−1.70)			
Assets (at filing, CPI adjusted) (log)						−3.82*	
						(−1.81)	
Leverage ratio (at petition) (%)						−0.07	
						(−0.69)	
Return on assets (pre-petition) (%)						−0.00	
						(−0.01)	
Stock volatility (post-emergence) (%)						−0.58*	
						(−1.76)	
Pre-packaged (d)							4.72
							(0.68)
Creditors' committee (d)							−30.37
							(−1.23)
Equityholders' committee (d)							−0.20
							(−0.05)
DE or NY SD (d)							−17.65
							(−1.25)
Constant	25.70**	26.10*	9.04	29.76**	25.15**	70.53**	59.46*
	(2.36)	(1.96)	(1.39)	(2.57)	(2.25)	(2.30)	(1.91)
Emergence year dummies	N	Y	N	N	N	N	N
File year dummies	N	N	Y	N	N	N	N
Industry dummies	N	N	N	N	Y	N	N
N	52	52	52	52	52	52	52
R^2	0.14	0.21	0.17	0.14	0.31	0.19	0.27

Table 4: The Effect of Disclosure and the Information Environment

We estimate ordinary least squares (OLS) regressions to examine the cross-sectional variation in the effect of bond price dissemination on court misvaluations in Chapter 11 reorganizations. The table reports coefficients as well as t-statistics based on robust standard errors (in parentheses). We use ***, **, and * to denote that the estimated coefficient is significantly different from zero (two-tailed) at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Disclosed (d)	−188.13***	−27.94*	−32.76**	−46.15***	−32.36**
	(−3.30)	(−2.00)	(−2.35)	(−3.63)	(−2.35)
Assets (at filing, CPI adjusted) (log)	−25.72***				
	(−4.80)				
Disclosed (d) x Assets (log)	22.12***				
	(3.28)				
Analyst coverage (d)		−55.97***			
		(−5.18)			
Disclosed (d) x Analyst coverage (d)		44.76**			
		(2.67)			
Outside bids during Ch. 11 (d)			−44.25*		
			(−2.01)		
Disclosed (d) x Outside bids during Ch. 11 (d)			38.77		
			(1.51)		
Vultures among largest unsecured creditors (d)				−63.22***	
				(−4.26)	
Disclosed (d) x Vultures among largest creditors (%)				48.08***	
				(2.82)	
Actively traded bonds (d)					−55.97***
					(−5.18)
Disclosed (d) x Actively traded bonds (d)					53.57***
					(3.15)
Constant	253.50***	69.95***	71.67***	83.65***	69.95***
	(5.62)	(6.47)	(6.43)	(7.80)	(6.47)
N	52	52	52	52	52
R^2	0.25	0.17	0.16	0.29	0.16

Table 5: Difference-in-Differences Sample: Summary Statistics

We estimate difference-in-differences (DID) regressions to estimate the effect of bond price disclosure via the Trade Reporting and Compliance Engine (TRACE) on the size of court misvaluations (Panel A) and consequent inter-claimant wealth transfers (Panel B). Post-TRACE is a dummy variable that equals one for firms that emerge from Chapter 11 on or after February 14, 2005 (the last day of the TRACE implementation window). Because our DID design does not allow for inclusion of firms with disseminated bonds in our pre-TRACE sample, we exclude from the estimation firms whose bonds prices were disclosed and reorganization was completed on or before February 14, 2005 (7 firms). The table reports coefficients as well as t-statistics based on robust standard errors (in parentheses). We use ***, **, and * to denote that the estimated coefficient is significantly different from zero (two-tailed) at the 1%, 5%, and 10% level, respectively.

Panel A. Average Misvaluations

	Before TRACE			After TRACE			
	(1) Bond	(2) No Bond	(3) Difference	(4) Bond	(5) No Bond	(6) Difference	(7) DID
Misvaluation (%)	67.0	46.1	20.9	38.1	59.3	−21.2	−42.1**
Misvaluation (%) <25%	21.1	45.5	−24.4	50.0	28.6	21.4	45.8**
Misvaluation (%) [25% to 50%)	21.1	27.3	−6.2	23.1	28.6	−5.5	0.7
Misvaluation (%) [50% to 100%]	26.3	13.6	12.7	15.4	14.3	1.1	−11.6
Misvaluation (%) >100%	31.6	13.6	17.9	11.5	28.6	−17.0	−35.0*
Observations	19	22	41	26	14	40	

Panel B. Absolute Priority Violations

	Before TRACE			After TRACE			
	(1) Bond	(2) No Bond	(3) Difference	(4) Bond	(5) No Bond	(6) Difference	(7) DID
100 x Intended violation (d)	21.1	27.3	−6.2	15.4	14.3	1.1	7.3
Avg. size of intended violation	0.3	1.2	−0.9	0.7	1.4	−0.6	0.3
100 x Unintended violation (d)	36.8	13.6	23.2*	11.5	35.7	−24.2*	−47.4**
Avg. size of unintended violation	25.7	0.0	25.7**	2.8	7.4	−4.6	−30.3**
Observations	19	22	41	26	14	40	

Panel C. Bankruptcy Characteristics

	Before TRACE			After TRACE			
	(1) Bond	(2) No Bond	(3) Difference	(4) Bond	(5) No Bond	(6) Difference	(7) DID
100 x Pre-packaged (d)	63.2	54.5	8.6	46.2	35.7	10.4	1.8
Days in Chapter 11 (log)	5.4	5.3	0.1	5.7	5.7	0.0	−0.1
100 x Creditors' committee (d)	84.2	90.9	−6.7	96.2	78.6	17.6*	24.3*
100 x Equityholders' committee (d)	10.5	9.1	1.4	38.5	7.1	31.3**	29.9*
100 x Court: Delaware or New York S.D. (d)	63.2	59.1	4.1	92.3	78.6	13.7	9.7
Observations	19	22	41	26	14	40	

Panel D. Firm Characteristics

	Before TRACE			After TRACE			
	(1) Bond	(2) No Bond	(3) Difference	(4) Bond	(5) No Bond	(6) Difference	(7) DID
Assets (at filing, CPI adjusted) (log)	7.3	7.9	−0.6	8.2	7.9	0.3	0.9
Leverage ratio (at petition) (%)	117.2	117.2	0.0	107.3	137.9	−30.7	−30.7
Stock volatility (post-emergence) (%)	15.7	23.1	−7.4*	18.5	16.9	1.5	8.9*
Return on assets (pre-petition) (%)	3.6	4.0	−0.3	7.4	1.8	5.6	5.9
100 x Analyst coverage (d)	5.3	9.1	−3.8	50.0	35.7	14.3	18.1
Observations	19	22	41	26	14	40	

Table 6: Difference-in-Differences Regressions

We estimate difference-in-differences (DID) regressions to estimate the effect of bond price disclosure via the Trade Reporting and Compliance Engine (TRACE) on the size of court misvaluations (Panel A) and consequent inter-claimant wealth transfers (Panel B). Post-TRACE is a dummy variable that equals one for firms that emerge from Chapter 11 after February 14, 2005 (the last day of the TRACE implementation window). Because our DID design does not allow for inclusion of firms with disseminated bonds in our pre-TRACE sample, we exclude from the estimation firms whose bonds prices were disclosed and reorganization was completed on or before February 14, 2005 (7 firms). The table reports coefficients as well as t-statistics based on robust standard errors (in parentheses). We use ***, **, and * to denote that the estimated coefficient is significantly different from zero (two-tailed) at the 1%, 5%, and 10% level, respectively.

Panel A. Size of Court Misvaluations

	(1)	(2)	(3)	(4)	(5)
Traded bonds (d)	20.92	16.74	19.34	33.26***	20.30
	(1.51)	(1.24)	(1.29)	(3.04)	(1.41)
Post-TRACE (d)	13.17	32.28	10.64	25.02**	15.54
	(0.83)	(1.23)	(0.71)	(2.03)	(0.90)
Traded bonds (d) x Post-TRACE (d)	−42.12**	−44.62**	−42.73**	−56.61***	−39.75*
	(−2.05)	(−2.15)	(−2.01)	(−3.36)	(−1.91)
Emergence year dummies	N	Y	N	N	N
Industry dummies	N	N	Y	N	N
Firm characteristics	N	N	N	Y	N
Bankruptcy characteristics	N	N	N	N	Y
N	81	81	81	81	81
R^2	0.07	0.28	0.12	0.33	0.09

Panel B. Size of Unintended APR Violations

	(1)	(2)	(3)	(4)	(5)
Traded bonds (d)	25.70**	25.25*	26.85**	21.55**	24.65**
	(2.35)	(1.74)	(2.43)	(2.13)	(2.43)
Post-TRACE (d)	7.40**	1.35	7.51	4.89	8.57
	(2.10)	(0.92)	(1.45)	(1.15)	(1.60)
Traded bonds (d) x Post-TRACE (d)	−30.33**	−32.02**	−33.59***	−23.94**	−24.70**
	(−2.61)	(−2.11)	(−2.84)	(−2.10)	(−2.13)
Emergence year dummies	N	Y	N	N	N
Industry dummies	N	N	Y	N	N
Firm characteristics	N	N	N	Y	N
Bankruptcy characteristics	N	N	N	N	Y
N	77	77	77	77	77
R^2	0.15	0.20	0.26	0.18	0.22