The Market for Borrowing Corporate Bonds*

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This version: June 16, 2010

This paper describes the market for borrowing corporate bonds using a comprehensive dataset from a major lender. The cost of borrowing corporate bonds is comparable to the cost of borrowing equity, between 10 and 20 basis points per year. Factors that increase borrowing costs are percentage of inventory lent, loan size, and rating. Trading strategies based on cost or amount of borrowing do not yield excess returns. Bonds with corresponding CDS contracts are more actively lent than those without. Finally, the 2007 Credit Crunch increased the variance but did not affect average borrowing cost or size of loan activity.

* We thank seminar participants at the JACF Conference in Honor of Stew Myers, the Harvard Finance lunch, and Jeri Seidman for comments. In addition, we are grateful to Sharat Alankar, Joseph Keith, Ted Keith, Patrick Sissman and Caroline Hane-Weijman for research assistance. We also thank a number of practitioners, in particular Kevin Corgan, for answering our questions about how this market works. Finally, we thank the Q Group for their financial support.

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I. Introduction

This paper examines three primary hypotheses about the market for borrowing corporate bonds. The first is whether borrowing corporate bonds is more expensive and illiquid than borrowing stock. It is not. The borrowing costs for corporate bonds are usually low and linked to the costs of borrowing stock. In addition, we estimate that shorting represents 19.1% of corporate bond trades. The second hypothesis is whether bond shorting is motivated by investors possessing private information. The evidence is that it is not and bond short sellers do not on average earn excess returns. The third primary hypothesis we examine is whether bond borrowing activity is affected by the credit default swap (CDS) market. While it appears that bond shorting and CDS issuance are correlated, bond short selling has not been replaced by the growth of CDS.

Short selling, where feasible, is an important activity in many asset markets. Constraints on short selling may lead to mis-valuation because they limit the ability of some market participants to influence prices. These constraints include various institutional or legal prohibitions on taking short positions as well as the additional costs and risks associated with short selling. There is a large theoretical literature on short sales constraints and their impact on asset prices. The empirical literature on short sales, while also large, has focused almost exclusively on stocks.

In this paper, we analyze the market for borrowing and shorting corporate bonds. The corporate bond market is one of the largest over-the-counter (OTC) financial markets in the world. Between 2004 and 2007, the time period of our study, the value of outstanding corporate debt averaged slightly over $6 trillion dollars and, according to the Securities Industry and Financial Market Association (SIFMA), trading activity averaged $17.3 billion per day.

Our analysis of shorting corporate bonds allows us to determine if the empirical findings on shorting stock are present in other markets. In addition, unlike stocks, where borrowing takes place in an OTC market and short selling takes place on an exchange, both borrowing and shorting activities take place OTC in the corporate bond market. Thus, any effects of short sale constraints may be amplified in the bond market.

A major issue in the study of any OTC market is the availability of data. Unlike equity short positions, which are reported monthly by the stock exchanges (the NYSE reports bi-monthly beginning September 2007), bond shorting is not regularly reported. In addition, while a number of studies have access to proprietary databases of equity short selling from lenders for short periods (e.g., D'avolio 2002; Geczy, Musto, Reed 2005), comparable analyses of bond short sales do not exist, with the exception of Nashikkar and Pedersen (2007).

Our paper uses a large proprietary database of corporate bond loan transactions from a major depository institution for the four year period, January 1, 2004 through December 31, 2007. Although our data is only from one lender, the size and coverage of our database allows us to view the functioning of an otherwise relatively opaque, yet large market. Our lender's par value of loanable bond inventory averages $193 billion daily and accounts for 2.9% of the overall par value of outstanding corporate bonds listed by the Fixed Income Securities Database

(FISD). From this inventory, our lender loans an average daily par value of $14.3 billion and 64.4% of bonds which appear in inventory are lent out at some point during our time period 2004-2007.

We first use this database to study the costs of borrowing corporate bonds. We then relate these costs to bond and loan market characteristics. Next, we evaluate whether highly shorted bonds underperform and whether bond short sellers earn abnormal returns. We also examine how the market for borrowing corporate bonds is related to the market for borrowing stocks and to the CDS market. Finally, we look for evidence on how this market is affected by the 2007 "Credit Crunch."

In our database, the mean and median annual borrowing cost, equally-weighted by loan, are 33 and 18 basis points (bps) for the entire sample period. By 2007, these rates fall to 19 and 13 bps, respectively. This drop is largely because bond loans under 100 bonds have much higher borrowing costs in the early part of our sample, but are almost identical to bond loans over 100 bonds by the end of our sample. This change occurs in April 2006.

Borrowing costs are related to several factors other than loan size. Three significant factors are on-loan percentage, which is the fraction of the lender's inventory already lent, the bond's credit rating, and the identity of the borrowing broker. Borrowing costs remain flat until on-loan percentage reaches approximately 70% and then rise sharply. Lower rated bonds have higher borrowing costs, and borrowing costs jump at ratings downgrades and bankruptcy filings. Finally, while our lender lends to 65 brokers, a select few borrow at significantly lower rates.

Next, we calculate excess returns from portfolios of highly shorted bonds. A trading strategy of shorting a portfolio of highly shorted bonds does not underperform various risk-adjusted benchmarks, even in the absence of the transaction costs of forming these positions. In addition, since our database provides us with the beginning and ending date of bond loans, we are able to calculate the excess returns realized by bond short sellers. We find that there are no significant excess returns to short selling.

We also investigate the linkage between stock and corporate bond short sales. Our lender has a significant role in stock shorting, which allows us to compare the borrowing costs for corporate bonds to the same firm's stock borrowing costs. The costs of borrowing the two securities are usually quite close and generally differ by a fixed amount. Over our sample period, about 80% of matched bond and stocks loans differ exactly by six fixed amounts and 60.1% are within 10 basis points of each other. When the borrowing costs of corresponding bonds and stocks are not close, it is generally because the stock is more expensive to borrow than the bond.

Credit default swap (CDS) contracts provide an alternative means for investors to profit from price declines in corporate bonds. While we find that almost half of our shorted bonds have CDS contracts available, these bonds are the most actively shorted and represent over three quarters of our loans. The existence of CDS contracts does not preclude borrowing corporate bonds. However, borrowing costs of bonds with CDS contracts are higher than those without;

one basis point higher when measured cross-sectionally and slightly more than two basis points higher in our regression analysis.

The Credit Crunch of 2007 began in the second half of that year. In this period, borrowing costs became more volatile, primarily because of variability in the credit market. However, the volume of bond shorting remains stable, as did the average level of borrowing costs. In addition, the average returns to shorting bonds did not change.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the mechanics of shorting a bond and estimates the market's size. Section 4 describes our data sample and Section 5 describes the costs of borrowing. Section 6 examines the performance of bond short sellers. The next two sections consider the consider how corporate bond shorting relates to stock shorting and the CDS market. Section 9 studies the Credit Crunch of 2007. Finally, Section 10 outlines some implications of our results and concludes.

II. Related Literature

The theoretical literature of the effects of short sales constraints on asset prices is extensive. One modeling approach examines the implications of heterogeneous investor beliefs in the presence of short sales constraints and whether there can be mis-valuation. Miller (1977) argues that short sales constraints keep more pessimistic investors from participating in the market, so market prices reflect only optimists' valuations (see also Lintner 1971). Harrison and Kreps (1978) consider a dynamic environment and provide conditions where short-sale constraints can drive the price above the valuation of even the most optimistic investor. More recent contributions include Chen, Hong and Stein (2002) who relate differences of opinion between optimists and pessimists to measures of stock ownership and Fostel and Geanokoplos (2008), who consider the additional effects of collateral constraints.

Another approach to studying the effects of short sales constraints focuses on search and bargaining frictions when investors must first locate securities to short (Duffie 1996, Duffie, Garleanu and Pedersen 2002). Finally, there is a strand of literature in the rational expectations tradition, which examines how short sale constraints can impede the informativeness of prices (see Diamond and Verrechia 1987, and Bai, Chang, and Wang 2006).

The empirical literature on short sales constraints is almost entirely about stocks. An early strand of this literature focused on the information content of short interest (see Asquith and Meulbroek 1995). This literature advanced in two directions as richer data sets became available to researchers. The first direction examines daily information on the quantities of short sales by observing transactions either from proprietary order data (Boehmer, Jones and Zhang 2008) or from information available from the SEC's Regulation SHO (Diether, Lee, Werner , Zhang 2009). Both papers suggest that short sellers may possess private information and that trading strategies based on observing their trades generate abnormal returns. The second direction in this literature focuses on prices, or direct measures of the cost of borrowing stocks (D'avolio 2001, Jones and Lamont 2002, Geczy, Musto, Reed 2002, Ofek et. al 2004). This literature uses either data from a unique time period when the market for borrowing stock was public (Jones and Lamont 2002) or proprietary data from stock lenders to measure borrowing costs. Jones and Lamont (2002) and Ofek et. al. (2004) find that stocks with abnormally high rebate rates have lower subsequent returns, while Geczy et. al. (2002) argue that highest costs of borrowing stocks that are on special do not eliminate the abnormal returns from particular short selling strategies. All four papers find that only a small subset of stocks are expensive to short. In D'avolio's (2001) sample, for instance, only 9% of the stocks in his sample are on special.

A challenge identified in this literature is that short interest is a quantity and borrowing costs are a price, both of which are simultaneously determined by the intersection of the demand for shorting and the supply of shares available to short. A high borrowing cost may indicate either a high demand for shorting or a limited supply of shares available to short. As a result, some researchers have constructed proxies for demand and supply and have tried to isolate shifts in either demand or supply. Asquith, Pathak and Ritter (2005) use institutional ownership as a proxy for the supply of shares available for shorting and find that stocks that have high short interest and low levels of institutional ownership significantly underperform the market on an equally-weighted basis from 1988-2002, but not on a value-weighted basis. Using richer, proprietary loan level data from a custodian who lends out small stocks, Cohen, Diether and Malloy (2007) examine shifts in the supply and demand for shorting, and find that an increase in shorting demand leads to negative abnormal returns. Both papers highlight that the results apply only to a small part of the overall equity markets.

The only other paper on corporate bond market shorting is Nashikkar and Pedersen (2007), who describe a proprietary dataset from a corporate bond lender between September 2005 and June 2006. Their examination of the cross-sectional determinants of borrowing costs and the role of credit risk complements ours. A limitation of their analysis is that they only cover a nine-month period. Because of our longer time period, we are able to examine some of the time series patterns such as the existence and disappearance of bimodality in the distribution of borrowing costs and the 2007 Credit Crunch. In addition, we examine a number of additional features of bond market shorting, such as the importance of borrower identity in determining borrowing costs. Finally, we examine the profitability of portfolio strategies based on observing borrowing costs and the relationship between bond and stock shorting.

In addition, there is a related literature which describes the transactions costs and price impact of trading corporate bonds. Bessembinder, Maxwell, and Venkataraman (2008) develop a model to test the effect of public transaction reporting on trade execution costs. Edwards, Harris, and Piwowar (2007) describe transaction costs in the corporate bond market using the TRACE dataset. This literature finds that transaction costs are higher for bonds than for stocks, but decrease significantly with trade size. It also finds that bonds, which are highly rated and recently issued, have lower transactions costs. Examining borrowing costs, not transaction costs, we find that borrowing costs for stocks and bonds are similar but that size and rating do have an effect.

III. Shorting a Corporate Bond: Mechanics and Market Size

The primary purpose of borrowing a corporate bond is to facilitate a short sale of that bond. Aside from market making activities, investors short bonds for the same reason they short stocks: to bet that the security will decline in price. Often, these bets involve views about the particular credit quality of a corporate bond, rather than views about overall future interest rate movements. Government bonds allow an investor to take a position solely on the market movement of interest rates, so we expect that investors who believe interest rates will rise prefer to short government bonds rather than corporate bonds. Corporate bond shorting may also be part of an arbitrage strategy involving relative misvaluations, such as trades related to the capital structure of a particular firm or trades related to CDS-corporate bond misvaluations. In addition, corporate bonds may be borrowed short term to facilitate clearing of long trades, in the presence of temporary frictions in the delivery process.

The mechanics of shorting corporate bonds parallel those of shorting stocks. Shorted bonds must be first located and then borrowed. The investor has three days to locate the bonds after placing a short order. Investors usually borrow bonds through an intermediary such as a depository bank. Such banks serve as custodians for financial securities and pay depositors a fee in exchange for the right to lend out shares. The borrower must post collateral of 102% of the market value of the borrowed bond, which is re-valued each day. Loans are typically collateralized with cash although US Treasuries may also be used. In our sample, 99.6% of bonds are collateralized by cash. Investors subject to Federal Reserve Regulation T must post an additional 50% in margin, a requirement that can be satisfied with any security. The loan is "on-demand", so that the lender of the security may recall it at any time. Hence, most loans are effectively rolled over each night, and there is very little term lending.

The fee that the borrower pays for the bond loan is expressed in terms of a rebate rate. This is the interest rate that is returned by the lender of the security for the use of the collateral. For example, if the parties agree to a bond loan fee of 20 basis points, and the current market rate for collateral is 100 basis points, then the original owner of the corporate bond returns, or "rebates", 80 basis points back to the borrower undertaking the short position. There can be great variability in the rebate rate for the same bond even on the same day. It is even possible that the rebate rate is negative, which means the borrower receives no rebate on their collateral and has to pay the lender. Finally, if a bond makes coupon payments or has other distributions, the borrower is responsible for making these payments back to the original owner of the security.

There are no available data series on the size of the market for shorting corporate bonds. This is primarily because bond trades are not publicly classified as either short or long. There is limited information about the size of the market for shorting stocks. All three major stock exchanges release short interest statistics once monthly.[1] Short interest is the number of shares that is shorted at a point in time. After dividing by total number of shares outstanding, short interest is often represented as a percentage of a stock's market value. In addition, equity shorting information is available during the period January 2005 through July 2007, when Regulation SHO was in effect requiring all exchanges to mark equity trades as long or short. This is no longer the case.

Examining stock short interest statistics released by the exchanges, Asquith, Pathak, and Ritter (2005) report that in 2002 the equally-weighted average short interest for corporate stocks is approximately 2.4% for the NYSE and AMEX combined, and 2.5% for the NASDAQ-NMS.

[1] As mentioned above, the NYSE reports bi-monthly beginning September 2007.

In addition, Diether, Lee, and Werner (2007) find that short sales represent 31% of share volume for NASDAQ-listed stocks and 24% of share volume for NYSE-listed stocks in 2005.[2] Finally, using equity loan databases from the same proprietary lender as in this paper, Asquith, Au, and Pathak (2006) report that our proprietary lender lent 16.7% of all stocks shorted on the NYSE, AMEX, and NASDAQ-NMS markets during the SHO period (or 5.0% of all stocks traded).

To estimate the size of the market for shorting corporate bonds, we assume that our proprietary lender's share of the bond shorting market is identical to their share of the equity shorting market. That is, we assume our lender's market share for shorting bonds in 16.7% of all bonds shorted. From Table 1, discussed below, the average daily par value of the bonds on loan by our proprietary lender is $14.3 billion. This is a measure comparable to short interest, i.e. it is the daily average of par bonds shorted over our sample period. If we assume that our lender represents 16.7% of the bonds lent, then total bonds lent on a average day is $85.6 billion. This is 1.3% of the par value of the average amount of corporate bonds outstanding as reported from the FISD database discussed below. Thus, by this measure, bond shorting is approximately half as large as equity shorting.

The average daily new loan volume of our proprietary lender is $550.3 million. If we again assume our proprietary lender is responsible for the same proportion of loans to bond short sellers as they are to stock short sellers, this implies that the average daily par value of corporate bonds shorted is $3.3 billion. SIMFA reports that the average daily corporate bond trading volume for the years 2004-2007 is $17.3 billion. By this measure, bond short selling would represent 19.1% of all corporate bond trades.

Using these estimates implies that shorting corporate bonds is an important market activity. The percentage of corporate bonds shorted, 1.3%, is slightly over half the percentage of equities shorted, 2.5%. Furthermore, the percentage of all daily corporate bond trades that represents short selling, 19.1%, is almost two-thirds the percentage of equity trades that entails short selling, 29.8%. Thus, at any point in time the stock of corporate bonds shorted is large and trading in the corporate bond market entails significant short sale activity.

IV. Description of Sample

We use four separate databases, two that are commercially available and two that are proprietary, to construct the sample of corporate bonds used in this paper. All four databases cover the period from January 1, 2004 through December 31, 2007. The commercially available databases are the Trade Reporting and Compliance Engine Database (TRACE) and Fixed Income Securities Database (FISD). The two proprietary databases are a bond inventory database and a bond loan database. These databases were provided to us by one of the world's largest custodian of corporate bonds. The bond inventory database contains all corporate bonds available for lending, and the companion bond loan database describes the loans made from that inventory. The bond CUSIP is used as the common variable to link these four databases.

[2] Asquith, Oman and Safaya (2010) find for a sample of NYSE and NASDAQ stocks, that short trades are 27.9% of trading volume in 2005. Asquith, Au, and Pathak (2006) also examine short sales and report that short sales represent 29.8% of all equity trades on the NYSE, AMEX, and NASDAQ-NMS exchanges during the SHO period.

TRACE is a database of all OTC corporate bond transactions and was first implemented on a limited basis July 1, 2002. TRACE reports the time, price, and the quantity of the bond trade, where the quantity is top-coded if the par value of the trade is $5 million or more for investment grade bonds and $1 million or more for high yield bonds. Over time, bond coverage expanded in phases and the compliance time for reporting and dissemination of bond prices shortened.[3] Our sample begins between Phase II and III of TRACE. Phase II was implemented on April 14, 2003, while Phase III was implemented by February 7, 2005. Phase III required reporting on all public corporate bond transactions. Since the vast majority of corporate bonds are traded over-the-counter, TRACE provides the first reliable daily pricing data for the market in corporate bonds.

We begin by matching the proprietary bond inventory database to the FISD database using the bond CUSIPs. The FISD database contains detailed information on all corporate bond issues including the offering amount, issue date, maturity date, coupon rate, bond rating, whether the bond is fixed or floating rate, and whether it is issued under SEC Rule 144a. We exclude any corporate bond in the inventory file that we cannot match to FISD. In addition we also exclude all convertibles, exchangeables, equity-linked bonds, and unit deals.

The proprietary bond inventory database contains the number of bonds in inventory and number of bonds available to lend. From January 1, 2004 through March 30, 2005 we have end-of-the month inventory information for all bonds. The database reports daily inventory information from April 1, 2005 to December 31, 2007. In contrast to the inventory database, the loan database is updated daily for the entire period January 1, 2004 through December 31, 2007.[4] For each day, the loan database includes which bonds are lent, the size of the loan, the rebate rate paid to the borrower, and an indicator of who borrows the bond. The proprietary loan database identifies 65 unique borrowers for corporate bonds. These borrowers are primarily brokerage firms and hedge funds.

Table 1 describes the match between the proprietary bond inventory and loan databases to the overall universe of FISD corporate bonds averaged by day. For 2004 to 2007, the average number of bonds in the inventory database is 7,752. This represents 20.7% of all corporate bonds in FISD for an average day. The relationship between the number of bonds in FISD and the inventory is stable over each of the four years. Although not aggregated in Table 1, there are a total of 15,493 unique bonds in the bond inventory sample that match to FISD over the entire period. In addition, 2,901 or 37.4% of bonds in the lender inventory are on loan on an average day. There is a slight upward trend in the fraction of bonds in the inventory lent from 2004 to 2007. The number of unique bonds lent on an average day is just over 7% of the total number of

[3] Phase I of TRACE covered transaction information on approximately 500 bonds. It required users to report transaction information on covered bonds to the NASD (later changed to FINRA) within 75 minutes. Phase II of TRACE expanded coverage of bonds to approximately 4,650 bonds. On October 1, 2003 the time to report was shortened to 45 minutes. A year later, on October 1, 2004, reporting time was shortened again to 30 minutes. Phase III of TRACE expanded coverage to almost all publicly traded bonds. Finally, on July 1, 2005 the reporting time was shortened to 15 minutes. Most reported trades are immediately disseminated by FINRA.

[4] There are several missing days in the loan database. On these days the file we obtained from the proprietary lender was either unreadable or a duplicate of an earlier daily file. These days are December 16- 31, 2004, all of February 2005, June 7, 2006, and November 27, 2007.

unique bonds in the FISD database. There are 9,971 unique bonds in the merged database that are lent at some point during the four-year period.

The bottom half of Table 1 reports similar comparisons using the par value of the bonds. The average daily par value of corporate bonds outstanding in the FISD database during the period 2004 to 2007 is $6.6 trillion, while the average daily par value of corporate bond inventory in the database is $193 billion. This represents 2.9% of the total par value of corporate bonds issued and listed in FISD. Of this inventory, an average $14.3 billion, or 7.4% of the total par value of the inventory, is on loan each day. Analyzing the databases by year shows no particular trend between 2004 and 2007.

In Figure 1, we plot the evolution of the corporate bond loans from the proprietary lender over time. The left-hand axis reports the number of loans outstanding, while the right-hand axis shows the total par value of these loans. On an average day over the four years, there are between 7,000 and 11,000 outstanding loans. The total par value of outstanding loans also fluctuates around the overall mean of $14.3 billion, with a maximum of more than $16.8 billion in October 2004, and a minimum of about $10.5 billion in January 2004.

Table 1 and Figure 1 clearly demonstrate that the number and value of corporate bonds and corporate bond loans in the two proprietary databases are large. The bond inventory database covers 20.7% of the bonds in FISD. The par value of the inventory is $193 billion on average, representing 2.9% of the $6.6 trillion market. In total, the proprietary database consists of 367,749 loans, covering 9,971 bonds, representing an average par value of $14.3 billion per day. We believe this is of sufficient size to draw inferences about the total market.

Sample Characteristics

Table 2 compares various bond characteristics from FISD to the proprietary inventory and loan databases by year and for the entire period. We focus on characteristics that likely affect the demand and supply for corporate bond loans and have sufficiently high data quality. The characteristics we examine are the size at issue, maturity, time since issuance, percent defaulted, percent floating rate, and percent subject to SEC Rule 144a. Rule 144a is a provision, which allows for certain private resale of restricted securities to qualified institutional buyers. Table 2 allows us to determine how representative the proprietary databases are of the entire corporate bond market.

Table 2 shows that the average bond in the inventory is much larger at issue ($418.6 million) than the average FISD bond at issue ($175.4 million). The average bond lent is even larger at issue with a size of $493.8 million. The average maturity at issue of the bonds in the inventory database (10.7 years) is close to the average maturity of the universe of all FISD corporate bonds (11.3 years). The average maturity at issue for lent bonds is 12.0 years. A comparison of time since issuance indicates that lent bonds are not outstanding as long as the average bond in the inventory or in FISD.

There are no year-to-year trends in the values of these bond characteristics. It should be noted that the values for some of the variables, e.g. maturity and time since issuance, over the entire period are outside the range of the per-year means. This is because each bond is only counted once for the entire period, but may be counted multiple times when counting the observations in the per-year columns. For example, the number of FISD, inventory, and lent bonds for the entire sample period is not the respective sums of the four separate years.

Bonds in the FISD database are less likely to default (0.6%) than bonds in inventory (1.1%) and the default percentage for lent bonds is between the two (0.8%). Bonds on loan are much less likely to be floating rate bonds (10.4%) than bonds in either the FISD dataset (22.3%) or the inventory dataset (17.0%). The fraction of bonds that are subject to SEC Rule 144a is much higher in the FISD and inventory samples than the bonds on loan. These patterns (except for Rule 144a data) hold for the yearly comparisons as well.

Panel B of Table 2 reports Standard and Poors (S&P) rating characteristics of corporate bonds. The coverage of the S&P ratings information in FISD is not as extensive as those characteristics reported in Panel A, however. For instance, there are 57,622 bonds in FISD where we observe the size at issue, while we observe S&P ratings for only 31,145 of these bonds. Fortunately, the limited coverage of ratings in FISD has a smaller impact on the inventory and loan samples. While we have issue size information for 9,971 lent bonds, we have an S&P rating for 9,025, or 90.5% of lent bonds.

The bond inventory has a lower median rating at time of issue than the universe of FISD corporate bonds, BBB versus A. The median rating over our entire time period is BBB+ for bonds in the inventory and A- for all FISD bonds. The sample of lent bonds has the same rating at issue as inventory, but a lower rating over the entire period. The other rows of Panel B, which show percentage investment grade at issue and percentage investment grade as of the date of the loan, show a pattern consistent with the lower ratings for lent bonds than for FISD bonds.[5]

In summary, Table 2 shows that shorted bonds are much larger at issue than the average bond in the FISD database, have a slightly longer maturity at issue than the average maturity of FISD bonds, and have a lower median rating at issue which has further deteriorated. 79.2% of all FISD bonds are investment grade at issue while only 69.0% of the lent bonds are. Lent bonds are also more likely to be fixed rate and less likely to be defaulted.

Properties of shorting positions

Each loan in the loan database has a unique loan number, which allows us to describe the time series properties of lent positions. Using the loan number, we are able to determine when the loan is initiated, the duration of the loan, the rebate rate, and number of bonds lent over the duration of the loan. Table 3 provides descriptive statistics for the new bond loans in the database for the overall period and by year. While there are 9,971 unique bonds lent in the database, there are 367,749 unique loans or an average of 36.9 loans per bond issue.

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[5] The data on treasury spreads has a different pattern. The lent bonds have a smaller spread to treasuries than do our inventory or the FISD database. It is important to note, however, that the available information on treasury spreads is much smaller than that of bond ratings, and therefore these two descriptive are not directly comparable since the samples are different. The notes in Table 2 give more information on this issue.

The data in Table 3 indicates that the size and duration of loans are quite skewed. The average loan size (at par value of $1,000) is $1.44 million, but the median loan size is only $350,000. The mode loan size is $100,000. The average new loan is outstanding for 33 calendar days while the median new loan is outstanding for 11 days. The mode duration of new loans is one day. There is a decrease in mean and median loan size from 2004 to 2007 (the median drops from $490,000 to $250,000). The distribution of duration of new loans is relatively stable over the four years.

The last three rows of Table 3 show how loan size changes during the life of the loan. Changes to loan size may occur if borrowers partially repay the loan or if portions of their loan are recalled by the lender. In the sample, just under a third of the loans are reduced in size before the loan is closed. Of the loans which change size, the average decrease is 56.8% of the initial loan size, and there are on average 1.88 loan decreases. We do not observe increases in loan size, presumably because a borrower who wishes to borrow more bonds initiates a new loan.

Tables 1, 2, 3 and Figure 1 show that the proprietary inventory and loan databases are extensive. The inventory database covers over 25% of all corporate bonds issued and the loan database contains over 367,000 loans on almost 10,000 bonds. The average amount in inventory per day is $193.3 billion and the average amount on loan per day is $14.3 billion. The lent bonds are larger, have a longer duration, and a lower rating than the average bond in the FISD database. Loan activity, while varying somewhat, is large and fairly constant throughout the entire period. New bond loans average over $1.4 million and have an average duration of 33 days. Finally, approximately one third of loans are partially repaid before being closed out.

V. Costs of Borrowing Corporate Bonds

The borrowing cost for corporate bonds has two major components: the rebate rate paid by the lender and the market interest rate which the borrower forgoes on the collateral. The rebate rate is the interest rate the lender pays on the collateral posted by the borrower and is typically lower than the market rate that the borrower could receive on the same funds invested at similar risk and duration elsewhere. Thus, we calculate the cost of borrowing as the difference between the market rate and the rebate rate. The loan database gives the rebate rate paid by the lender but not the market rate. We use the one-month commercial paper rate as the market rate.[6]

Even though most corporate bond loans are short term, as shown in Table 3, borrowing costs vary frequently over the life of the loan. Table 4 shows that there are more than 17 changes in borrowing cost for each loan over its lifetime and more than 80% of the bond loans in the sample experience a change in their borrowing cost before repayment.

These changes are due both to changes in the commercial paper rate and changes in the rebate rate. In the sample, 79.9% of the loans have a commercial paper change and 53.3% of all loans have a rebate rate change during their term. There appears to be no time trend with these

[6] An alternative to the commercial paper rate is the Fed Funds rate. We use the commercial paper rate because we think it more properly represents the rate the borrowers could get on their collateral balances. For most of the period, January 1, 2004 through December 31, 2007 the commercial paper and Fed Funds rates correlate highly (the average difference across days is 4.9 basis points and the coefficient of correlation is .998).

result, however, as the number of loans with changes in borrowing costs, the commercial paper rate, and/or the rebate rate is roughly equivalent over all four years.

It is possible for the lender to change the rebate rate frequently because all of the loans are demand loans. In addition, if credit conditions for the loan improve, and if the bank does not lower the rebate rate, the borrower has the option of closing out the loan and borrowing from a different lender. For the loan sample, there is an average of more than 6 rebate rate changes per loan, or approximately 12 rebate rate changes for those loans with a change. Furthermore, rebate rate changes go in both directions. 48.9% of all loans have a rebate rate increase, 41.3% have a rebate rate decrease, and 36.9% of loans have both. Hence, a considerable factor driving changes in the cost of borrowing is that the rebate rate is re-priced by the lender.

The frequent changes in borrowing costs suggest that existing loans should track current market conditions. Comparing new and existing loans, the average difference in the borrowing costs for the same bonds on the same day is 4.3 basis points, with a standard deviation of 27.6 basis points. Moreover, for this subsample, 46.5% of new loans are more expensive than existing loans and 35.4% are cheaper than existing loans. However, since all loans start as new loans and since new loans must reflect current market conditions, the analyses below only use the borrowing cost for new loans unless otherwise stated.

Characteristics of Borrowing Costs

Table 5 Panel A presents the borrowing costs on new loans over time, equal-weighted by loan and value-weighted by loan size. The average borrowing cost, equally-weighted by loan (EW), is 33 basis points, and the median borrowing cost is 18 basis points over the period 2004 to 2007. When we weight borrowing costs by the size (or par value) of the loan (VW), the mean drops to 22 basis points and the median to 14 basis points. This indicates that smaller loans have higher borrowing costs than larger loans. Panel A also shows that new loan borrowing costs fall substantially in 2006 and 2007. For example, the equally-weighted median borrowing costs for 2004 to 2007 are 31, 49, 16, and 13 basis points, respectively. This pattern is also reflected in the mean, as well as all the percentiles shown. This temporal decrease holds for both equally-weighted and value-weighted borrowing costs.

Table 5 Panel B presents borrowing costs over time divided by loan size. We divide loans into those of 100 bonds or less (i.e., $100,000 par value, the mode loan size) and those of more than 100 bonds. The results show that large loans have lower borrowing costs than small loans, but this difference diminishes over time. For example, in 2004, the mean borrowing cost for loans of 100 bonds or less, “small” loans, is 51 basis points. For loans of more than 100 bonds, “large” loans, the mean borrowing cost is 31 basis points. By 2007, the mean borrowing cost for small loans is 19 basis points, which is identical to that of large loans.

Thus, Table 5 shows that, on average, loan rates fall over time and that the difference between equally-weighted and value-weighted borrowing costs are reduced in 2006 and 2007. In addition, this decrease in borrowing cost is steeper for small loans than for large loans. Small loans are substantially more costly than large loans at the beginning of our sample period but are almost equivalent by the end of our period.

Figure 2 plots the equally-weighted borrowing cost quintiles monthly over our sample period. It shows that the distribution of borrowing costs changes abruptly after March 2006. Before that date, the 60th and 80th percentiles of borrowing costs are usually at or above 50 basis points for each month. After March 2006, the 60th percentile is at or below 20 basis points for each month. The 80th percentile drops below 20 basis points in August 2006 and is near or below 20 basis points until the start of the Credit Crunch in August 2007. The plot of par value-weighted loan borrowing costs, although not shown, shows a similar if less dramatic pattern during the same time period. This indicates that there was a substantial change in the pricing of bond loans in early to mid 2006 for both large and small loans.

Figure 3 presents histograms of equally-weighted borrowing costs pre- and post- April 2006. The lighter 'before' histogram shows that the most frequent borrowing cost pre-April 2006 is between 51 and 55 basis points, with the second most frequent borrowing cost is between 11 and 15 basis points. This bimodal distribution pattern is significantly changed in the darker 'after' histogram. The most frequent borrowing cost post-April 2006 is between 11 and 15 basis points, and the percentage of observations in that range is more than twice that of the highest range in the 'before' histogram. The range between 51 and 55 basis points is now the 7th most frequent. Although not shown, the corresponding value-weighted histograms are similar.

The reasons why borrowing costs are reduced in early 2006 and why small loans began to be priced closer to large loans after that date are not immediately clear. Table 1, Table 2, and Figure 1 show that the lender's inventory of bonds and the amount lent do not change significantly after 2005. Further, as shown in Table 3, the average size and duration of bond loans also do not change significantly over time. Therefore, we cannot explain the change in borrowing costs with simple supply or demand proxies.

Another factor why borrowing costs change over time may be greater transparency in bond market pricing related to the growth of TRACE during our sample period. The sample begins between Phase II and III of TRACE. As stated above, Phase II was implemented on April 14, 2003, while Phase III was implemented by February 7, 2005. The last phase required reporting on all public corporate bond transactions. It seems unreasonable, however, that it would take a full year, until April 2006, for the effects of this increased coverage to have an impact. Finally, the growth of the CDS market may have driven improvements in the liquidity of corporate bonds and the narrowing of borrowing costs spreads may reflect this trend. We investigate the impact of the CDS market for the market for borrowing corporate bonds in Section 8 below.

Determinants of borrowing costs

We first investigate how the cost of borrowing is related to the available supply of bonds in the lender's inventory. As previously mentioned, we do not have daily inventory data from January 2004 until March 2005, and thus cannot compute the daily available supply of bond inventory during this period. Figure 4 plots the relationship between the average borrowing cost and the amount of inventory on loan for the period April 2005 to December 2007 and for several sub-periods. The vertical axis displays average borrowing cost, and the horizontal axis displays amount of inventory lent. For the entire period, the average borrowing cost is relatively flat at 30 basis points for bonds that are less than 70% lent out. After that level, however, there is a steep increase in the average borrowing cost: each 10% increase in the amount lent out is associated with more than a 10 basis point increase in the average borrowing cost.

Also included on Figure 4 are separate plots of average borrowing costs versus available inventory for the period April 2005 to March 2006 and for the period April 2006 until December 2007. Those two plots show that the borrowing costs are significantly lower in the latter period, consistent with the results in Table 5 and Figures 2 and 3. However, the kink at 70% of available inventory still exists, and although borrowing costs are lower in the latter period, the slope of that segment is similar. This suggests that the reduction in borrowing costs in the latter half of our sample period is not due to changes in inventory. Finally, the line for the 2007 Credit Crunch is also plotted in Figure 4. We will discuss that result below in Section 9.

Second, Table 6 presents the 35 corporate bonds with the highest borrowing costs in the sample. Each bond is listed once, together with its maximum loan borrowing cost and the date and loan rate corresponding to that maximum. Since there is a great deal of clustering by firm of the most expensive bonds to borrow, the last column of Table 6 also indicates the number of bonds from that issuer where the borrowing cost is greater than the 100th most expensive to borrow bond in the sample. For example, the borrowing cost of the most expensive loan on the Calpine Corp bond with CUSIP 131347AW6 is 14.50%, but there are 8 other Calpine Corp bonds which have borrowing costs above the 100th most expensive to borrow bond in the sample.

There are three features of the bonds in Table 6 that are worth noting. First, these bonds are highly lent out. The average percentage on loan is 80.2%, well above the 70% 'kink' observed in Figure 4. Second, most of the firms in Table 6 experienced credit problems around the date they appeared on our list. Of the 35 bonds on the list, 10 are bankrupt as of the date of the loan, while another 6, while not filing for bankruptcy, were downgraded in the year prior. In addition, 7 of the firms, while not bankrupt or downgraded, were frequently mentioned in the press in the previous year as "financially struggling." Interestingly, 8 of the remaining firms undertook an LBO during this period. Although we didn't check explicitly, we infer the increased leverage from the LBO impacted the bond's borrowing cost.

Third, a large fraction of the most expensive bond loans take place during the latter half of 2007. Thirteen out of 35 bond loans in our list are after July 1, 2007, and 8 of these are on one day, October 31, 2007. Importantly, all 8 have negative rebate rates on that date. This means their inclusion cannot be explained solely by that day's reported commercial paper rate.

Calculated borrowing costs are not always positive. A negative borrowing cost is the result of the lender paying a rebate rate above the commercial paper rate and it implies that the lender loses money on the loan. In total, we have 11,971 loans (or 3.3% of the total) with negative borrowing costs in the sample. Most of the loans with negative borrowing costs, however, coincide with the 2007 Credit Crunch from August 2007 until December 2007. This can be seen in Figure 2, which shows that the borrowing cost of the bottom quintile becomes negative after July 2007. Of the 11,971 loans with negative borrowing costs, 8,832 of them occur between August and December 2007, of which 7,960 are on only 26 different days.

There is more than one possible reason why the cost of borrowing is negative for some bond loans. It is possible that the reported one-month commercial paper rate, which we take from the Federal Reserve Board's website, is not representative of the true market conditions for all days. This is particularly true for those days with very large intra-day interest rate movements. During the 2007 Credit Crunch, the Fed eased credit and dropped the Fed Funds rate several times, causing the commercial paper rate to fall as well. It is also possible that the proprietary lender is slow to respond to changes in credit conditions. Finally, it should be noted that during the credit crunch in the last half of 2007, the Fed's intervention caused short term rates to fall substantially below medium term rates. If the reinvestment rate on collateral received by the lending institution is above short term rates, the lender can still make a profit on their bond loans even with negative borrowing costs.[7] In order to examine whether the market for lending bonds in the period July to December 2007 is different, we examine this time period separately from the January 2007 to June 2007 period. We will note in Section VIII differences in any of the results for this later time period.

Regression Analysis of Borrowing Costs

Although we know that borrowing costs are lower in 2006 and 2007 than they are in 2004 and 2005, and that borrowing costs are dependent on the size of the loan and the available inventory to borrow, it is hard to discern the driving factors of bond loan pricing from the univariate comparisons we have made so far. We next conduct a multivariate analysis which allows us to simultaneously control for the factors we have examined in determining a bond's borrowing cost.

The bond's characteristics may affect borrowing costs in several ways. The bond's time since issuance may be important if it affects how widely the bond is held, and thus how difficult it is to locate, or if investor beliefs become more heterogeneous the longer the bond is outstanding. The availability to borrow may also be proxied by whether debt is public or private (Rule 144a), as private debt may be harder to sell short. Smaller issue size may also make the bonds harder to find, increasing borrowing costs. Other bond factors that may affect borrowing costs include the bond's rating and whether the bond is fixed or floating rate. Bonds with lower ratings might attract more loans because of their higher probability of default, and thus have higher borrowing costs. Finally, the value of floating rate bonds re-price with interest rate movements and thus are less likely to deviate from par.

Since borrowing costs are determined by the intersection of supply and demand, borrowing costs may be higher the greater the percentage of bonds already lent. In addition, after holding inventory constant, larger loans may have lower borrowing costs if there is a discount for larger size. Further, borrowing costs may differ by borrower if the lender either gives a discount

[7] Our loan database provides a reinvestment rate which the lender estimates they will receive on the collateral. This rate is not constant across all loans or even across all loans on one particular bond at a point in time. The reason for this is that the lender invests the collateral in a number of different funds as directed by each bond's owner. These funds can have a different duration and different risk than that represented by investing short term at the commercial paper rate. We ignore these reinvestment rates when calculating borrowing costs since they do not represent the return the borrower receives on their collateral.

to large volume borrowers or if some borrowers are more knowledgeable about the lending market than others.

Our regression model incorporates the data on bond characteristics from Table 2 as well as loan size and on loan %. In addition, we include dummy variables for each bond's CUSIP, the initiation day of the loan, and for the borrowing broker. These allow us to fix bond characteristics and to study how pricing varies with loan market variables such as loan size, available inventory, and borrower identity. Since daily inventory data is only available after March 2005, the regression analysis covers the period April 2005 through December 2007. We specify the following model for the borrowing cost of loan *i* on bond *b* on day *t*:

$$\text{Borrowing Cost}_{ibt} = \text{CPrate}_t - \text{RR}_{ibt} = \beta_1 * \text{on loan }\%_{bt} + \beta_2 * \text{loan size}_i + \beta_3 * \text{rating}_{bt} + \beta_4 * \text{issue size}_b + \beta_5 * \text{time since issue}_{bt} + \beta_6 * \text{floating rate}_b + \beta_7 * \text{rule144a}_b + \delta_t + \kappa_b + \lambda_{broker} + \varepsilon_{ibt}$$

where CPrate is the one month financial commercial paper rate (in our model 100 basis points = 1.00) and RR is the rebate rate (with the same scale as the CPrate). The on loan % is the percentage of daily inventory already lent, and loan size is the total number of bonds lent in thousands of bonds (that is, the loan value in $ millions). Rating is the bond's rating at the time of the loan (where AAA is given a value of 1 and D is given a value of 22. All intermediate ratings are given consecutive values between 1 and 22). Issue size is the size of the initial bond offering (in $100 millions). The time since issue variable is the time since the bond was issued (in years). The floating rate variable is a dummy variable equal to 1 if the bond pays a floating rate coupon and 0 if the bond has a fixed rate coupon. The Rule 144a variable is a dummy variable equal to 1 if the bond was issued under SEC Rule 144a and 0 otherwise. δ_t represents a set of dummies for each trading day in the sample. κ_i represents a set of dummies for each bond CUSIP in the sample, and λ_{broker} are a set of dummies for each unique borrower in the sample who borrows 100 or more times during our sample period.[8] We report heteroscedasticity-robust standard errors.

Table 7 reports estimates from four specifications of the above regression: one without broker or bond CUSIP dummies, one with broker dummies, one with bond CUSIP dummies, and one with both. The specifications with bond CUSIP dummies do not include issue size, time since issuance, floating rate, and Rule 144a since these characteristics do not change over time and are completely captured by the bond-specific and date effects.

In all four specifications the on loan % is positive and significant. In the two specifications without CUSIP dummies, the coefficient is 0.2956 without broker dummies and 0.2923 with broker dummies. When we add the bond-specific controls, the estimate falls to 0.0411 and 0.0525. The coefficients are reduced because the bond-specific controls pick up much of the variation in a bond's inventory for the lender. Still, consistent with the pattern we observed in Figure 4, the larger the percentage of the inventory lent, the higher the borrowing

[8] Our lender identifies 65 borrowers. 40 make 100 or more loans and 25 make less than 100 loans. The average number of loans made by the largest 40 is 9,178 and the average made by the smallest 25 is 25. Restricting our sample to the period covered by the regression, there are a total of 62 borrowers, 38 of which make 100 or more loans.

cost. Increasing the percentage lent by 10% is associated with an increase in borrowing costs by 2.9 basis points across the sample of all bonds. For a specific bond, a 10% increase in percentage lent is associated with an increase of 0.4 to 0.5 basis points on average.

Loan size is negative and significant in each specification. Our regression results on loan size show that the larger the loan, the lower the borrowing cost. The magnitude of the coefficient is economically large and similar across all four regression models, ranging from -0.0123 to -0.0201. This means that adding 1000 bonds to loan size decreases borrowing costs by 1.23 to 2.01 basis points.

The coefficients on bond ratings are positive and significant in all four specifications. This implies that the lower rated the bond, the higher the borrowing costs. The magnitude of the estimate is larger when we include bond-specific controls. For the specification in column (4), with broker and CUSIP dummies, the estimates imply that a full letter downgrade raises borrowing costs by 10.86 basis points (three times the regression coefficient estimate of 0.0362).

The estimated coefficient for issue size is positive and significant for the first two specifications, but is small. Issue size must increase by $300 million for borrowing costs to increase by 1 basis point. The coefficient on time since issuance is positive and significant in the two specifications without CUSIP dummies, implying that the longer a bond is outstanding, the higher the borrowing cost. For every year a bond is outstanding, the borrowing cost increases by almost 0.7 basis points.

The last two bond characteristics from Table 2 are indicators for floating rate bonds and for whether a bond is Rule 144a. The estimates imply that fixed rate bonds are about 6 basis points more expensive to borrow than floating rate bonds and that the borrowing costs for Rule 144a bonds are about 2 basis points more expensive.

Which borrower initiates a loan is also important in determining borrowing costs. The proprietary database only allows us to observe the initial borrowing firm; it does not allow us to determine the final party undertaking the loan transaction. In the database each bond is lent to one of 65 unique borrowers who then either deliver the bonds to their own institutional and retail clients for short selling or keep them for their own account. The specifications in Table 7 columns (2) and (4) include the 65 borrower dummies. For both specifications, we can reject the hypothesis that all unique borrower coefficients are zero. The difference between maximum and minimum broker coefficients and the 75th and 25th percentile broker coefficients are also reported in Table 7. In column (4), the "best" borrower receives borrowing costs 58 bps less than the "worst" borrower. This means, that on the same day for the same CUSIP and loan size, the lowest cost broker is able to borrow at a rate 58 basis points less than highest cost broker. This difference is considerably larger than the average borrowing cost reported in Table 5 of 33 bps. The difference between the 75th and 25th percentiles is 19 bps. Both are statistically significant.

Table 8 further explores whether some brokers obtain lower borrowing costs. We examine all days where two or more borrowers borrow the same bond. Requiring that a borrower "compete" with another borrower on the same day at least 100 times restricts us to consider 26 borrowers. For this group, we rank each borrower's "performance" on that day for that bond by evaluating whether they received a lower, higher, or the same borrowing cost as another competing borrower[9]. Those results are summarized in Table 8 and show that some borrowers receive consistently lower borrowing costs. We ran two sets of "competitive" races per borrower. One set was between two borrowers only; the second set was between three or more borrowers. The top-rated borrower received the lowest borrowing cost for any given day and bond 92.5% of the time when there were two borrowers and 78.9% of the time when there were three or more borrowers for the same bond on the same day.

The two winning percentages of the top rated borrower are both significant using the sign test. In fact, the top eight borrowers all have winning percentages which are significantly greater than 50% at the 1% level when "competing" with one other borrower and significantly greater than 33% when competing with two or more borrowers. Furthermore, success in the competitive races is not dependent on the number of loans or the amount borrowed by the borrower. Rank order correlations between placement in the competitive races and either the number of loans or the dollar amount of the bonds borrowed are not significant. Thus it appears that differences in borrowing costs between borrowers reflect differences in market knowledge and abilities to negotiate borrowing costs.[10]

To summarize, the borrowing cost regression results in Table 7 show that a smaller loan size, a higher percentage of inventory lent, and a lower bond rating leads to higher borrowing costs. These results hold for all four specifications of the model, although the coefficients for on loan % are weaker when CUSIP dummies are included. Finally, the identity of the borrower significantly influences borrowing costs, both in aggregate and when comparing loans for the same bond, regardless of the borrower's volume.

Borrowing costs around credit events

We next look at borrowing costs around credit events. The events we examine are bankruptcy filings and large credit rating changes. We define a large credit rating change as a movement of three or more S&P ratings, or one full letter or more, e.g. going from an A+ to a B+ or from a BB- to a AA-. There are 212 bonds in the inventory database of corporate bonds involved in a bankruptcy, representing 90 unique bankruptcies. However, only 69 bonds have lending activity during the period from 30 trading days before until 30 trading days after the bankruptcy, which corresponds to 39 unique bankruptcies.

The average borrowing cost of these bonds for each of the 61 days is plotted in Figure 5. Since there are new loans for only 2.2 bankrupt bonds per day in the period -30 to +30 days around bankruptcy, we expand the sample by including old loans (which, as we saw above, are re-priced). This expands in Figure 5 the number of bonds per day with loans to an average of 45. Each bond does not have a loan outstanding for all 61 days. We have also done the analysis only

[9] The last line of Table 8 with Broker ID "Remainder" is a summary line that consolidates the other 39 brokers as one competitor. The competitive race results in columns 5-8 represent contests between the combined 39 brokers and any of the 26 brokers above. It does not include contests that the 39 remaining brokers have with each other.
[10] Each unique borrower's identity is available to us from the proprietary database, although we are not allowed, for confidentiality reasons, to disclose it. The differences in borrowing costs are consistent with our perceptions of reputation.

on new loans and only on bonds which have loans for all 61 days. Although there are far fewer observations, the results are qualitatively similar.

Figure 5 shows that bond borrowing costs are high for the entire period from -30 days to +30 days, where Day 0 is the bankruptcy filing date. The equally-weighted bond borrowing costs for firms that file bankruptcy are 176 basis points during the 30 days before filing. This is substantially greater than the average 33 basis points reported for all new loans in Table 5 for the sample and indicates that these bonds are difficult to borrow before bankruptcy. After bankruptcy, bond borrowing cost increases further to an average of 244 basis points for the 30 days after the filing. Thus, borrowing costs indicate that short sellers identify firms in financial distress prior to bankruptcy but that the bankruptcy filing is not completely anticipated since borrowing costs rise after that date.

In Figure 6, we report a similar analysis for large bond downgrades and upgrades. There are 296 full-letter upgrade events on bonds in the inventory, covering 284 unique bonds as some bonds have multiple upgrades. The data covers 128 of these events, which correspond to 125 unique bonds. The plot for these upgrade events shows that the average upgraded bond borrowing cost is close to the average for all bonds before the upgrade and does not vary much after the rating change. The average borrowing cost for the 30 days before the upgrade is 29.9 basis points, and the average borrowing cost for the 30 days after the upgrade is 32.0 basis points.

The bond borrowing costs for downgrades are much lower than those for bankruptcies, but are above the average of all bonds and increase after the downgrade. There are 392 full-letter downgrade events during our time period on 367 unique bonds. The data covers 210 of these events on 197 bonds. The average borrowing cost for the bonds involved in a full letter downgrade is 37.4 basis points in the 30 days before the downgrade and 50.9 basis points in the 30 days after the downgrade. It is important to remember that all downgrades are included, including those between investment grades, i.e. from an A+ to a BBB+, and thus all downgrades did not signal financial distress.

Thus, Figures 5 and 6 show that bankruptcies and large credit downgrades increase a bond's borrowing cost, while large credit upgrades do not decrease a bond's borrowing cost.

VI. Returns to Shorting Bonds

In the last section, we calculated borrowing costs, described their cross sectional and time series distribution, and examined some of their important determining factors. In this section, we do a similar analysis on the returns to shorting bonds. As mentioned above, we do not know if all borrowed bonds are necessarily shorted, but for the purposes of this section we assume they are. The literature on equity shorting that uses proprietary lending databases makes a similar, although usually unstated, assumption. The literature on shorting equity infers that the existence of excess returns from highly shorted stocks implies the existence of private information among short sellers and/or borrowing constraints. We make the same inference for the market for shorting bonds.

In order to calculate bond returns over any holding period, it is necessary to have bond prices at the beginning and end of the period. Following the approach of Bao and Pan (2009) we match the proprietary databases of bond inventory and loans to the FISD TRACE database. TRACE provides transaction bond prices. The number of bonds covered in TRACE increased once during our sample period, on February 7, 2005. This increase ostensibly extended TRACE's coverage to all US corporate bonds. Even with universal TRACE coverage, there are difficulties in computing bond returns. (See Bessembinder, Maxwell, Kahle and Yu (2010) for the difficulty of working with bond returns in general and TRACE in particular.)

We calculate bond returns with the following formula:

> Return = (Sale price – buy price + sale accrued interest – buy accrued interest + coupons paid) / (buy price + buy accrued interest).[11]

In this formula, the return is from the point of view of a long holder of the bond. That is, the returns are positive if the bond prices increase. A short seller of the bond, therefore, benefits if the return is negative. The formula assumes that sale and buy prices are "clean", meaning net of accrued interest, which is the way prices are reported in TRACE. In some databases, bond prices are "dirty", meaning they include accrued interest and the above formula has to be modified appropriately.

Of the 9,971 bonds that are ever loaned in the bond loan database, 8,212 bonds have at least one TRACE price observation, and 8,033 have at least ten TRACE price observations. If borrowed bonds are indeed shorted, every lent bond should result in a bond trade after February 7, 2005, when TRACE's universal coverage became effective. After February 7, 2005 we have at least one TRACE price on 84.4% of the lent bonds. Since a bond must only be delivered to a buyer within three trading days of a short sale, a bond loan does not always occur on the same day as the linked trade. They can either be located first and then sold short, or sold short and then located 3 days after the sale. Of the 367,749 bond loans, 301,167 have TRACE prices both within the period three days before the initiation of the loan and three days after the initiation.

The fact that bonds do not trade every day and that short sales may occur on different days than the bond loans complicates calculating holding-period returns. As a result, our approach to calculating monthly returns for a bond is not precisely over thirty days because the bond may not trade exactly one month apart. We compute a monthly bond return when a bond has a trade in two consecutive calendar months. If there is more than one bond trade in a calendar month, we use the price of the last trade in that month. Following Bessembinder, Maxwell, Kahle, and Yu (2010) we exclude bond trades that are cancelled or modified or include commissions. An equally-weighted monthly portfolio return is then calculated by equally weighting the monthly returns of the individual bonds in the portfolio. A value-weighted monthly portfolio return is calculated by weighing returns by the market value, computed as the offering amount times the price of the bond in the month that the portfolio was formed. Weekly returns are calculated in a similar manner.

[11] This is Bessembinder, Maxwell, Kahle, and Yu's (2010) formula with a correction for a typographical error in that paper.

Returns to portfolios of shorted bonds

In Table 9, we create portfolios from bonds that are borrowed. In Panel A, we form monthly portfolios based on the borrowing cost of the bonds. The first row of the Table reports returns for all new loans. Each bond is then assigned a borrowing cost equal to the borrowing cost of the last new loans in the month, median-weighted by loan size. Then, for each month we calculate borrowing cost quintiles and assign bonds to one of the five portfolios. We report one-month returns for these portfolios as well as for portfolios that include only bonds in the 95th and 99th percentiles of borrowing costs.

In column 1, we report the number of bonds in each portfolio. Quintile sizes are not equal because borrowing costs are not continuous; that is, multiple loans have identical borrowing costs. Column 3 reports the equally-weighted raw return, while column 7 reports equally-weighted excess portfolio returns. Columns 5 and 9 report value-weighted raw and excess portfolio returns, where value-weighted means we weight returns by the issue size.[12] We calculate excess returns by subtracting from the portfolio raw returns the equally-weighted and value-weighted returns of the TRACE index.[13]

The results in Table 9 Panel A show that the portfolio of bonds with new loans does not significantly underperform. In fact, the value-weighted excess return in column 9 for the entire portfolio is 0.00%. Moreover, Panel A does not support the hypothesis that bonds which are more expensive to borrow are more likely to have lower returns in the future. The 95th and 99th percentile portfolios have the highest borrowing costs, but they also have the highest average returns across all measures. Furthermore, the returns for the quintiles are not monotonic, and the 5th quintile, with the highest borrowing cost, has the highest returns of the quintile portfolios in columns 3, 5, 7, and 9. In addition, the equally-weighted portfolio excess returns in column 7 though negative are small and the value-weighted portfolio excess returns in column 9 are all within 3 basis points of zero. Finally, the standard deviations of all portfolios returns, both equally and value-weighted, are much larger than the means. As a result, none of the excess returns are significantly different from zero or from each other.

The regression in Table 7 shows that borrowing costs are positively and significantly related to on loan %. Hence, Table 9, Panel B, we sort bonds by on loan % as of the last day of the month. Again, we form portfolios and calculate monthly holding returns. The first two rows of Panel B report the returns for portfolios of bonds that are not lent as well as those that are lent from the inventory. There is no significant difference in the raw or excess returns between these two portfolios. As in Panel A, we have quintile portfolios, ranked by on loan %, as well as the 95th and 99th percentile portfolios. These portfolios are formed conditional on the bonds being lent, that is, the 95th percentile portfolio is only selected from the universe of lent bonds. Panel B

[12] We calculated value-weighted returns several ways including using market values instead of issue size. This results in no significant differences relative to the discussion below.

[13] It is customary to use the Lehman Brothers (now Barclays) Corporate Bond Index when calculating bond excess returns (see, e.g., Bessembinder, Maxwell, Kahle, and Yu's (2010) and Bao and Pan (2009)). While we also used this technique, we calculated a separate bond index from the TRACE database. We do this for two reasons. First, the Lehman Index uses matrix pricing while our TRACE index uses transaction prices. Second, the Lehman Index is a single aggregate number and doesn't match as closely our sample, e.g., the Lehman Corporate Bond Index does not include high yield bonds, but we can and do include them in our TRACE index, since they are in our sample.

has more observations than Panel A because it includes all existing loans, where Panel A only includes new loans. The results in Panel B parallel those in Panel A: there are no significant results for any of the portfolios or any of the differences between the portfolios.

Table 9 shows none of the portfolio returns or differences in Panels A or B are statistically significant. That is, neither the bond's borrowing cost nor the on loan % predicts future returns. Although not shown, we also calculated one week, two week, and three-month returns for all of the portfolios in Table 9. In no instances were any of the portfolios significantly different from zero.

Profitability to short sellers of corporate bonds

Table 9 indicates that shorting portfolios of bonds with high borrowing costs or high on loan % is not a strategy that yields abnormal returns to short sellers. That is, Table 9 presents results from shorting portfolios of bonds that are already highly shorted. These may indicate, but do not accurately measure, whether short sellers made money on their short positions. It only measures whether there is additional money to be made from observing shorting positions already established. To evaluate the profitability of the actual short trades, we must know the period the short position was held and we must net out the borrowing costs and the overall movements in the bond market. The lent bond database, which has the start and end date of bond loans and the borrowing costs, allows us to do this analysis.

To calculate short sellers' profitability, we compute a return on capital net of coupons paid, accrued interest, and borrowing costs. We assume that the beginning and ending dates of a short position are the same as the beginning and ending dates of a bond loan. Since corporate bonds do not necessarily trade every day, we take as the starting price a bond price in the period three trading days before until three trading days after the loan's initiation. The ending price is from a bond trade in the period three days before until three days after the loan's termination. If there are multiple trades within an allotted period, we take the one closest to the loan date. We take the last trade of the day if there are multiple trades on a day.

Loans where the nearest trades are more than 3 days removed from either the loan start or end date are eliminated. We also eliminate loans where the starting and ending dates are matched to the same TRACE trade. This can occur if the loan is short term and there is only one reported TRACE trade during the time period from three days before the initiation until three days after loan termination. The profit from each loan, net of borrowing costs, accrued interest, and coupon payments, is then summed to obtain aggregate short sellers' profits over some period. This amount is then divided by the average capital invested during that period. Average capital invested is the summed daily par value of new and old outstanding loans divided by the number of days in the time period. Thus, the net return on capital is calculated as total net profit divided by average capital invested over a time period.

As an example, for the entire four year period, the total profit if all borrowed bonds were shorted is -$2.362 billion. The borrowing cost for all loans over the same period totaled $105 million. The average amount of bond loans outstanding per day is $11.765 billion.[14] Thus, the average monthly return over the four-year sample period is -49 basis points. This is close to the 42 basis point monthly value-weighted raw portfolio return in Panel A of Table 9. These two values would be even closer if Table 9 subtracted the average 2.8 basis point monthly borrowing cost.

This return is also close to the value-weighted market return for corporate bonds. Using the TRACE database over our four year sample period, the value-weighted monthly return for all corporate bonds in the inventory is 37 basis points per month. Thus, returns computed from actual short transactions are nearly identical to shorting the entire inventory of corporate bonds, on a value-weighted basis. This result is consistent with column (9) of Table 9 Panel A which reports that value-weighted return for the portfolio of all new loans net of TRACE is 0 basis points.

We next evaluate short seller profits by several loan characteristics: loan size, duration and borrowing cost. Loan size does not substantively change the result reported above, but the other two characteristics appear to be responsible for some variation in short seller profits. In particular, loans of one day duration, i.e. overnight loans, have substantially smaller losses, -16 basis points per month, than loans with duration longer than one day, -49 basis points per month.

The return on capital for loans where the borrowing cost is greater than 100 basis points is substantially lower than the return on loans where the borrowing cost is less than 100 basis points. The return on capital is -133 basis points per month for the more expensive loans and -46 basis points per month for the less expensive loans. Even though borrowing costs are higher for the more expensive loans, they only account for 32 basis points of the difference. This finding of larger losses for the high borrowing cost loans parallels the finding of high positive returns for the 95th and 99th borrowing cost portfolios in Table 9.

Table 9 showed that portfolios formed on the basis of bond shorting activity did not earn significant excess returns. Examining realized profits from the actual short trades indicate that short sellers do not have private information. In fact, the average monthly return for short sellers is negative and almost the reverse of the returns from holding the bond market. Thus, short selling corporate bonds appears to take place in an efficient market, with a small cost. This activity is consistent with short selling being used as a hedging activity, and short sellers paying for the hedge.

VII. Relationship between bond and stock shorting

We next investigate how the market for shorting corporate bonds is related to the market for shorting stocks. If the purpose of borrowing securities is to short the firm, we expect the two markets to be integrated. Given the priority of claims, the stock of a firm should lose its value before the debt, suggesting that investors who wish to express a negative view about the firm may prefer to short stocks. Although investors may short debt if it is easier to access and

[14] This number differs from the average daily par value of bonds on loan in the lender inventory in Table 1 because we only can compute profits when we have both beginning and ending TRACE prices and the loan must begin and end during our four year period.

cheaper to borrow than stock, the total market for shorting stocks is much larger than that of shorting bonds. While the proprietary lender made 367,749 bond loans over our sample period, they made 7,241,173 stock loans during the same time period.

To understand how the market for shorting corporate bonds is related to the market for shorting stocks, we matched each firm's bonds to its corresponding common stock. We match the first 6 digits of the bond CUSIP to the first 6 digits of the common stock CUSIP. This match was not complete since many of the bonds in the dataset are subsidiaries or private firms and have 6 digit CUSIPs which do not directly correspond to a common stock CUSIP. To add the subsidiary bonds (which may have a different 6 digit CUSIP), we hand matched the remaining bonds using SEC filings. To avoid potential biases that hand matching may introduce, we analyze our results for both methods separately, i.e. those that were matched with a 6 digit CUSIP versus those which were hand matched. There are 15,482 bond CUSIPs in the inventory file. We were able to match 5,686 using the 6-digit CUSIP match and an additional 4,476 were matched by hand. We found no significant differences in results between the two subsamples.

Another matching problem is that there are many firms with multiple bond issues. For instance, if there are 8 different GM bonds in inventory, we want to relate their borrowing costs to the cost of borrowing GM's common stock. We group all issues of bonds together for this analysis. The reason we group in this way is that for any given day, within the same firm, bond rebate rates are close. When different bonds from the same firm have a new loan on the same day, the median of the absolute value of the difference in borrowing costs is zero basis points. This means that for more than half the firm-day observations, the borrowing costs are the same for all bonds of a given firm. Furthermore, the 75th percentile of this distribution is only 4 basis points.

As a result, for our bond and stock analysis, if a firm has more than one new bond loan on a given day, we aggregate the borrowing costs across all bonds and all new loans by computing median borrowing cost, weighted by the number of bonds lent. Likewise, for stocks we take the median stock borrowing cost for new loans weighted by shares lent. 29.7% of new bond loans have a corresponding new stock loan on the same day.

Borrowing costs for matched sample

For most firms, there is a fixed difference in borrowing cost between bond and stock loans. In particular, 78% of the firms in the matched sample have loans whose bond and stock borrowing costs differ by one of six distinct values: -10bps, -5 bps, -1 bps, 0 bps, +35 bps, and +40 bps. This is seen in Figure 7 which plots the percentage of loans in the matched sample in each of these six categories over time.

The largest category in Figure 7 is new bond loans with borrowing costs 1 basis point below new stock loans. For the matched loans, this category accounts for an average of 39.4% of observations. This 1 bps difference is impossible to explain if bond and stock borrowing costs are not related. There are two other major fixed borrowing cost differences where bonds are cheaper to borrow than stocks. They are -5 basis points and -10 basis points which average 13.9% together.

The second largest category of fixed differences are bond loans with borrowing costs 35 bps more expensive than stock loans. This relationship changes, however, during our sample period. For the period from December 2004 until March 2006, the mean of this category is 23.4%. For the period from April 2006 until December 2007, the mean of this category is 6.8%. This drop is clearly shown in Figure 7 and April 2006 appears to be a fundamental shift in the pricing relationship between bond and stock loans. Moreover, the +40 bps category, where bond loans are 40 bps more expensive than stocks, disappears by June 2006. These changes coincide with reduction in the premium charged for small bond loans in April 2006, as described in Section 4.

There is a category that expands dramatically after March 2006: bond and stock loans that have the same borrowing cost. Before March 2006, the average percentage of matched loans in this category is 0.2%, while after March 2006, it is 7.1%. The percentage of loans in this category expands exactly when the percentage of loans in the +35 bps category decreases, although not by equal amounts. The -1 bps category also increases after March 2006.

While Figure 7 graphs the differences in bond and stock borrowing costs, it does not show their levels. This is explored in Table 10 which shows that 60.1% of loans in the matched sample have borrowing costs within 10 basis points of each other. This percentage rises to 69.0% by 2007. For those matched loans whose borrowing costs are not close to one another, it is more common for the stock loan to be the more expensive. In particular, only 1.2% of all matched bond loans are over 100 basis points, while 6.2% of matched stock loans are over 100 basis points. Furthermore, if a bond loan costs more than 100 basis points, 13.0% of matched stock loans also costs more than 100 basis points. For the inverse, if a stock loan costs more than 100 basis points, only 2.6% of the matched bond loans are over 100 basis points. This mean that it is more common for stock to be hard to borrow (as measured by borrowing costs) than it is for a bond and when a bond is harder to borrow, the stock is more likely to be as well.

To summarize, there are three main results on the relationship between bond and stock market shorting. First, most bonds and stocks loans for the same firm differ by one of six fixed amounts, which do not depend on the day of the loan. For example, differences in borrowing costs of bonds and stocks of exactly -1 bps and +35 bps constitute 55.4% of the matched sample. Second, bond borrowing costs are very close to stock borrowing costs for most matched loans. For matched bond and stock loans from the same firm on the same day, 60.1% of the borrowing costs are within +/- 10 bps of each other, a percentage which is increased to 69.0% by 2007. Finally, if neither the bond nor the stock is hard to borrow, they are priced very similarly. However, on a day when a stock is expensive to borrow, bonds from the same firm are usually not, and vice versa. This suggests that for low levels of borrowing costs these two securities lending markets are similar, but when borrowing costs are high they are fragmented.

VIII. Relationship between the market for shorting bonds and the CDS market

Rather than shorting a bond, another way for an investor to profit from a bond price decline is to purchase a credit default swap (CDS). This is similar to a stock investor purchasing a put. Unlike the options market for equities, which is smaller in notional amount than the stock market, the notional amount of CDS has become larger than the market value of corporate bonds. In mid 2009, the par value of corporate bonds was $6.8 trillion, while the notional principal amount of CDS on corporate debt was $12.1 trillion.[15]

There is a documented link between shorting stocks and the stock options market. Many dealers who write equity puts hedge their position by shorting the stock. There is also a link between option put-call parity and shorting constraints in the stock market (see, for example, Figlewski and Webb (1993) and Ofek, Richardson, and Whitelaw (2004)). We know of no research documenting similar links between shorting corporate bonds and the CDS market and believe this is a fertile area for future research.

We use Markit as the source for the CDS data. Markit collects data from various financial institutions, inter-dealer brokers, and electronic trading platforms. The data consist of daily CDS spreads for reference securities. Each CDS contract is assigned a REDCODE number by Markit, which we then map to individual bond CUSIPs. Because of cross-default provisions, CDS contracts can correspond to more than one bond for any given firm. As a result, we ultimately match CDS's to multiple bonds that share the first six digits of their CUSIPs.

Of the 15,493 bond CUSIPs ever in the lender's inventory, we are able to match 7,033, or 45.4% to a CDS. The percentage of bonds lent from inventory with a CDS is higher: of the 9,971 bond CUSIPs ever lent, 5,540, or 55.6% had a corresponding CDS at some point during our sample period. Furthermore, of the 367,749 new loans in the sample, 77.8% are of bonds with CDS. Thus, inventory bonds matched with CDS are more likely to be lent, and conditional on being lent, they constitute a much larger fraction of new loans. This suggests that there are common factors which determine which bonds have CDS contracts and which bonds are lent.

What the common factors are is not apparent by examining the bond characteristics in Table 2. Lent bonds with CDSs tend to be larger and have much higher credit quality than lent bonds without CDSs. For example, 70.7% of the lent bonds with CDSs are investment grade at the time of the loan, while only 50.4% of the lent bonds without CDSs are. Examining loan size and duration in a manner similar to Table 3, loans on bonds with CDSs are not outstanding as long on average, but have similar sizes and median duration. Importantly, the distribution of borrowing cost is almost identical between bonds with CDSs and those without. For example, the mean and median equally -weighted borrowing cost for bonds with CDSs is 33 and 19 basis points, while it is 32 and 18 basis points for bonds without CDSs.

When we include an indicator for CDS in the borrowing cost regression presented in Table 7, we find that the presence of a CDS results in a significant increase in borrowing costs of 2-3 basis points, and has no discernible impact on the relative importance of the other factors we examined. This cross-sectional comparison does not imply that the presence of a CDS causes

[15] Corporate bond value is from Securities Industry and Financial Markets Association (SIFMA), CDS value is from Depository Trust and Clearing Corporation (DTCC). These data are from 2009 because we are unable to find the breakout of corporate debt CDS during our sample period. The par value of outstanding corporate bonds in 2007 is $7.2 trillion.

higher borrowing costs; rather it may reflect the fact that bonds which are most likely to be shorted, and are thus more expensive to short, are also most likely to have a CDS contract.

To look at the impact of CDS on borrowing costs, we next examine the introduction of a CDS contract. We plot the borrowing cost for the 30 days before and after Markit first lists a CDS on a bond. This time series comparison holds fixed all other bond attributes unlike the previous cross-sectional comparisons. There are 274 new CDS introductions during our sample period on 1070 bonds that are lent. 496 of these bonds have borrowing cost data in the 61 day window. There is no noticeable change in borrowing costs over this period. The average borrowing cost for the 30 days prior to the introduction of a CDS contract was 32.9 basis points, while the average for the 30 days after was 31.7 basis points. There is also no noticeable increase or decrease in the amount lent. Since Markit does not collect information from all dealers, there is the possibility that CDS contracts exist for some bonds before they first appear in Markit.

In summary, bonds with CDS tend to have much higher loan activity than bonds without. In addition, borrowing costs for loans with CDS are slightly higher than those without. Finally, the introduction of a CDS contract does not materially affect borrowing costs in the short term. All of these facts suggest that CDSs are correlated with bond shorting, but do not substantially replace it.

IX. The 2007 Credit Crunch

The Credit Crunch of 2007-2008 started in late July or early August 2007. The 3-month LIBOR-OIS rate, the difference between LIBOR and the overnight indexed swap rate, increased from 12.25 basis points on August 1st to 39.95 basis points on August 8th. By September 10th, the rate was 94.90 basis points. The LIBOR-OIS rate is considered by many to be a "barometer of fears of bank insolvency."[16] This increase occurred shortly after Bear Stearns announced they were liquidating two hedge funds investing in mortgage-backed securities on July 31, 2007. The Federal Reserve Bank started taking immediate action, reducing interest rates starting in mid-August 2007.

We examine the impact of this turmoil in the credit markets on the market for borrowing corporate bonds. Although we do not have data from the entire Credit Crunch of 2007-2008 in our sample period, we are able to investigate the first six months, from July – December 2007. In particular, we investigate the impact of the Credit Crunch on lending activity, borrowing costs, and their determinants.

Figure 1 indicates that there was no distinguishable change in the number or par value of outstanding loans during the period July – December 2007 compared to the first half of 2007. Moreover, in Table 1, the average daily par value of bonds on loans in 2007 is $14.4 billion and the percentage of inventory lent is 7.3%. Although not shown, the average daily par value of bonds on loan for the first and second half of 2007 are both $14.4 billion, and the percentage of inventory lent changes from 7.1% to 7.5%. Both measures of loan activity are greater than 2006, but below the activity in 2005.

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[16] Alan Greenspan quoted in Thornton (2009).

The average characteristics of bonds lent, as examined in Table 2, also does not change between the first and the second half of 2007. The size and duration of lent bonds, shown in Table 3, also do not change in any meaningful way.

While the number, characteristics of bonds lent, and loan size do not change in the second half of 2007, borrowing costs do. Figure 2 shows that following the March 2006 period, the distribution of borrowing costs is compressed. During the first half of 2007, the spread between the 20th and the 80th percentile borrowing cost averages 6 basis points per month. In the second half, the spread expands and the average difference between the 20th and the 80th percentile is 28 basis points per month. This increase in spread is due to both an increase and decrease in borrowing costs. As seen in the Figure, the borrowing costs for the 80th percentile climbs from an average of 14 basis points to 28 basis points. At the same time, the borrowing cost for the 20th percentile falls from an average of 8 basis points to 0 basis points with three months showing negative borrowing costs.

This increase in volatility of borrowing costs does not affect the mean or median borrowing costs substantially. The mean equally-weighted and value-weighted borrowing cost for the first half of 2007 is 19 and 13 basis points, respectively. The comparable mean borrowing costs for the second half of 2007 are 20 and 13 basis points. The median equally-weighted and value-weighted borrowing costs behave similarly: they are 13 and 8 basis points in the first half of 2007 and 13 and 7 basis points in the second.

While the increase in volatility does not affect the mean or median, it does affect how often loans are re-priced. Although not shown, we perform an analysis as in Table 4 and found a large increase in the percentage of loans that have a change in their loan rebate rates during the second half of 2007. From Table 4, the average percentage of loans with changes in the rebate rate for the first three years, 2004-2006, is 49.6%. For the first half of 2007 the percentage with rebate rate changes is 57.8%, while for the second half it is 67.5%. Thus, the Credit Crunch of 2007 resulted in a much wider distribution of loan borrowing costs and these borrowing costs were reset more frequently than in the immediate past.

As discussed above in Section IV, this increased volatility in borrowing costs may be due to volatility in the measured commercial paper rate during the second half of 2007. During the second half of 2007, 17.6% of the loans have negative borrowing costs. In addition, 90% of these loans with negative borrowing costs occur on 26 days. It seems implausible that for more than 1/6 of the loans, the lender is paying borrowers for borrowing bonds. A more likely explanation to us is that the reported commercial paper rate does not reflect market conditions during this time period. It appears that all reported short term rates are suspect during this period since the prevalence of negative borrowing costs remains if we use the Fed Funds rate as the market rate. The discussion above on Table 6 is consistent with these observations.

This large number of loans with negative borrowing costs is the reason why in Figure 4, where we plot borrowing costs against inventory lent, the line for the July – December 2007 period is below the other plotted lines for most of the range. However, the slope of the line from this period continues to have a kink at 70% and the slope is similar to that of lines from earlier periods.

Since the distribution of borrowing costs widens during the second half of 2007, we re-estimate the borrowing cost regression presented in Table 7 using only data from the second half of 2007. For all four specifications of the model, the coefficients for the second half of 2007 have similar magnitudes and significance levels as the entire period presented in Table 7 and with the exception of the estimate for on loan %, there are similar estimates comparing the first and second half of 2007. The difference in the on loan % is not due to the second half of 2007 being different, but rather the first half of 2007 being different from the rest of the period. That is, the coefficient on loan % is smaller than the entire period or the second half of 2007 under each specification.

In summary, the Credit Crunch of 2007 affected the market for borrowing corporate bonds primarily by widening the distribution of borrowing costs. The number of loans, the types of bonds lent, the size of loans, and the average borrowing costs all remained relatively stable in the second half of 2007 compared to the prior period. The change we document in March 2006 appears to be more of a structural change than that occurring during the Credit Crunch of 2007.

X. Conclusion and Implications

This paper presents the first complete examination of short selling for securities traded in an OTC market. It does this by utilizing a detailed proprietary database of corporate bond loans from 2004-2007. It estimates that short selling constitutes 19.1% of the trading activity in the corporate bond market. This is about two-thirds of the percentage of short selling in equity markets.

The average borrowing cost of loans in the sample is 33 basis points per year on an equally-weighted basis and 22 basis points per year on a value-weighted basis for the entire period. These costs decline over time and by 2007 are 19 and 13 basis points. Small loans, under 100 bonds, are more expensive than large loans early in our sample period, but by the end the mean and median borrowing costs are identical. There was a structural change in the pricing of corporate bond loans in April 2006 that we cannot explain by either market or institutional factors. After that date not only did small loans become cheaper, but the entire distribution of borrowing costs, irrespective of loan size, is compressed.

Two other important factors, in addition to loan size, that determine borrowing costs are the lender's inventory and the bond's credit rating. When the lender has greater than 70% of its available bonds lent out, borrowing costs rise sharply. Furthermore, lower rated bonds are more expensive to borrow, and borrowing costs increase substantially immediately following bankruptcy. Bonds with credit downgrades not involving bankruptcy also experience borrowing cost increases, albeit less dramatic.

Another factor impacting borrowing costs is the identity of the borrower. Broker effects are significant both in our regression analysis and when running multiple-firm contests. Moreover, our results do not indicate that the pricing difference is due to volume however.

The changes in bond borrowing costs in April 2006 are characterized by three major structural changes. First, borrowing costs for all loans are reduced. Second, the relatively higher borrowing costs for small loans is reduced, and third, there is a reduction in the difference in borrowing costs between equity and bond loans. Since we are only dealing with data from one lender, we did not know if these changes are idiosyncratic or market-wide. Given the size and importance of the proprietary lender in this market, however, we assume any changes the lender made in borrowing costs would have an impact beyond itself.

There is no evidence that, on average, bond short sellers have private information. Portfolios formed on the basis of corporate bond borrowing costs or levels of borrowing activity do not generate excess returns. Moreover, in aggregate, bond short-sellers do not realize a profit from their trades. Finally, borrowing costs have a very small influence on overall trade performance.

These results are in contrast to some of the literature on equity short selling. That literature demonstrates that some short portfolios, based on selection criteria such as a high level of shorting activity and/or high borrowing costs, significantly underperform the market. In the sample of bond short selling, short portfolios based on these criteria do not underperform. This may be due to the fact that we are only examining bonds available in inventory from the lender. As such, there may not be any bonds in the sample which are analogous to “hard to borrow” stocks which underperform in the equity literature.

An important caveat to our work is that we only examine data from one lender, albeit a large one. This is particularly important when drawing conclusions about short sellers profiting from superior knowledge. The literature on short selling shows that short sellers receive excess returns only in very few cases, and that these instances are usually small stocks that have constrained borrowing due to the difficulty of locating them. By definition, the sample consists of bonds in the lender’s inventory, and thus they can be located. Still, given the number and size of bonds in the sample, the conclusion that the market for borrowing corporate bonds is efficient and short sellers in this market do not earn positive excess returns is valid. In fact, there is strong evidence that short sellers, on average, pay a small cost for shorting corporate bonds. This is consistent with shorting corporate bonds as a hedging activity for which users pay a price.

The market for borrowing corporate bonds appears to be linked closely to the market for borrowing equity. The borrowing costs for 78% of the matched bond and stock loans for the same firm on the same day differ by one of six fixed amounts. Further, the differences between borrowing costs for corporate bonds and stock are reduced after April 2006. By 2007, 69.0% of the matched borrowing costs are within plus/minus 10 basis points of each other, and 39.4% are within 1 basis point.

We investigate the impact of the CDS market on the market for borrowing corporate bonds tangentially. We find that bonds which have higher lending activity are more likely to have CDS contracts. Furthermore, we find that these bonds have small, one or two bps, but significantly higher borrowing costs than bonds without CDS contracts. These differences are after controlling for many of the other factors such as percent on loan, loan size, and bond rating. We conclude that the CDS market is correlated with bond shorting and is not a perfect substitute.

Finally, we examined the first six months of the 2007 Credit Crunch and compared it to the remainder of our period. We find that the volume and average pricing of corporate bond loans did not change. We did find, however, that the distribution of borrowing costs widened substantially during this period.

Our results speak to the larger literature on short sales constraints and their effects on asset prices. This literature has argued that short sales constraints may generate misvaluation and short selling takes primarily place for speculative reasons. At least for the sample of bonds covered by our lender, we find that while short selling is a large and important market activity, constraints, measured by borrowing costs, do not have a measurable impact on corporate bond pricing. In addition, we find that shorting securities traded in an over-the-counter market is very similar to shorting exchange listed securities. Moreover, the fact that portfolios of heavily shorted bonds do not generate excess returns suggest that speculation is not driving shorting activity. Finally, our results indicate that short selling is not responsible for the growth of the CDS market, nor is it being replaced by it.

References

Asquith, Paul, Andrea Au and Parag A. Pathak (2006): "Short Sales Constraints." Unpublished mimeo, MIT Sloan.

Asquith, Paul and Lisa Meulbroek (1995): "An Empirical Investigation of Short Interest." Unpublished MIT Working paper.

Asquith, Paul, Rebecca Oman and Chris Safaya (2010): "Short Sales and Trade Classification Algorithms." *Journal of Financial Markets*, forthcoming.

Asquith, Paul, Parag A. Pathak and Jay Ritter (2005): "Short Interest, Institutional Ownership and Stock Returns." *Journal of Financial Economics*, 78(2), 243-276.

Bai, Yang, Eric C. Chang, and Jiang Wang (2006): "Asset Prices Under Short-Sales Constraints." Working paper, MIT Sloan School of Management.

Bao, Jack and Jun Pan (2009): "Excess Volatility of Corporate Bonds." Working paper, MIT Sloan School of Management.

Battalio, Raymond and Paul Schultz (2006): "Options and the Bubble." *Journal of Finance,* 62, 2071-2102.

Bessembinder, Hendrik, William Maxwell, Kathleen Kahle, and Danielle Xu (2009): "Measuring Abnormal Bond Performance." *Review of Financial Studies*, 22, 4219-4258.

Bessembinder, Hendrik and William Maxwell (2008): "Transparency and the Corporate Bond Market." *Journal of Economic Perspectives*, Spring.

Bessembinder, Hendrik, William Maxwell, and Kumar Venkataraman (2006): "Market Transparency, Liquidity Externalities, and Institutional Trading Costs in Corporate Bonds," *Journal of Financial Economics*, 82(2), 251-288.

Boehmer, Ekkehart, Charles Jones, and Xiaoyan Zhang (2008): "Which Shorts Are Informed?" *Journal of Finance*, 63(2): 491-527.

Chen, Joseph, Harrison Hong and Jeremy C. Stein (2002): "Breadth of Ownership and Stock Returns." *Journal of Financial Economics,* 66: 171-205.

Cohen, Lauren, Karl Diether, and Christopher Malloy (2007): "Supply and Demand Shifts in the Shorting Market." *Journal of Finance*, 62: 2061-2096.

D'avolio, Gene (2002): "The Market for Borrowing Stock." *Journal of Financial Economics*, 66, 271-306.

Diamond, Douglas and Robert Verrechia (1987): "Constraints on short-selling and asset price adjustment to private information." *Journal of Financial Economics*, 18, 27-311.

Diether, Karl, K.-H Lee and Ingrid M. Werner (2009): "Short-Sale Strategies and Return Predictability." *Review of Financial Studies*, 22, 575-607.

Duffie, Darrell (1996): "Special Repo Rates." *Journal of Finance*, 51(2): 493-526.

Duffie, Darrell, Nicolae Garleanu, and Lasse Pedersen (2002): "Securities Lending, Shorting, and Pricing." *Journal of Financial Economics*, 66, 307-339.

Edwards, Amy, Larry Harris and M. Piwowar (2006): "Corporate Bond Market Transparency and Transaction Costs." *Journal of Finance.*

Figlewski, Stephen and Gwendolyn P. Webb (1993): "Options, Short Sales, and Market Completeness." *Journal of Finance*, 48, 761-777.

Fostel, Ana and John Geanakoplos (2008): "Leverage Cycles and the Anxious Economy." *American Economic Review,* 98(4), 1211-1244.

Harrison, J. Michael and David M. Kreps (1978): "Speculative Investor Behavior in a Stock Market with Heterogeneous Expectations." *Quarterly Journal of Economics*, 92(2), 323-336.

Geczy, Chris, David K. Musto, and Adam Reed (2002): "Stocks are Special Too: An Analysis of the Equity Lending Market." *Journal of Financial Economics*, 66: 241-269.

Jones, Charles M. and Owen Lamont (2002): "Short Sale Constraints and Stock Returns." *Journal of Financial Economics*, 66, 207-239.

Lintner, John (1971): "The Effects of Short Selling and Margin Requirements in Perfect Capital Markets." *Journal of Financial and Quantitative Analysis*, 6(5), 1173-1195.

Miller, Edward M. (1977): "Risk, uncertainty, and divergence of opinion." *Journal of Finance*, 32, 1151-1168.

Nashikkar, Amrut and Lasse Pedersen (2007): "Corporate Bond Specialness." *Working paper, New York University*.

Ofek, Eli and Matthew Richardson (2003): "DotCom Mania: The Rise and Fall of Internet Stock Prices." *Journal of Finance*, 58, 1113-1138.

Ofek, Eli, Matthew Richardson, and Robert Whitelaw (2004): "Limited Arbitrage and Short Sale Restrictions: Evidence from the Options Market." *Journal of Financial Economics*, 74, 305-342.

Securities Industry and Financial Markets Association (2009): Report on Outstanding U.S. Bond Market Debt

Thornton, Daniel L. (2009): "What the LIBOR-OIS Spread Says" Economic Synopsis, Federal Reserve Bank of St. Louis.

Table 1. Number and Par Value of Bonds in Corporate Bond Databases

Table 1 reports the number and par value of bonds in the FISD Corporate Bond, Proprietary Bond Inventory, and Proprietary Bond Loan databases for the overall period and by year. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. All data is daily, except for data from the proprietary inventory database which is only available monthly from January 1, 2004 to March 31, 2005.

Daily Average Number of Bonds					
	2004 - 2007	**2004**	**2005**	**2006**	**2007**
Number of Corporate Bond CUSIPs in FISD	37,535	32,919	35,796	37,471	39,163
Number of Corporate Bond CUSIPs in Both Lender Database and FISD	7,752	7,592	7,669	7,750	7,827
Percent of FISD Represented in Lender Database	20.7%	23.1%	21.4%	20.7%	20.0%
Number of Corporate Bond CUSIPs in Lender Database and FISD That Go on Loan	2,901	2,612	2,797	2,841	3,054
Percent of Corporate Bond CUSIPs in Lender Database and FISD That Go on Loan	37.4%	34.4%	36.5%	36.7%	39.0%

Par Value of Bonds					
	2004 - 2007	**2004**	**2005**	**2006**	**2007**
Average Daily Par Value of Existing FISD Bonds (Billions of $)	6,619	5,649	6,105	6,530	7,159
Average Daily Par Value of Existing FISD Bonds in Lender Inventory (Billions of $)	193.3	183.4	186.7	195.5	196.8
Lender Inventory as a % of FISD Par Value	2.9%	3.2%	3.1%	3.0%	2.7%
Average Daily Par Value of Bonds On Loan in Lender Inventory (Billions of $)	14.3	14.2	14.7	13.9	14.4
Lent as a % of Lender Inventory	7.4%	7.7%	7.9%	7.1%	7.3%

Figure 1. Number and Par Value of Outstanding Loans

Figure 1 plots the evolution of the corporate bond loans from the Proprietary Bond Inventory and Loan databases the over time. The left-hand axis reports the number of loans outstanding, while the right-hand axis shows the total par value of these loans. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007.

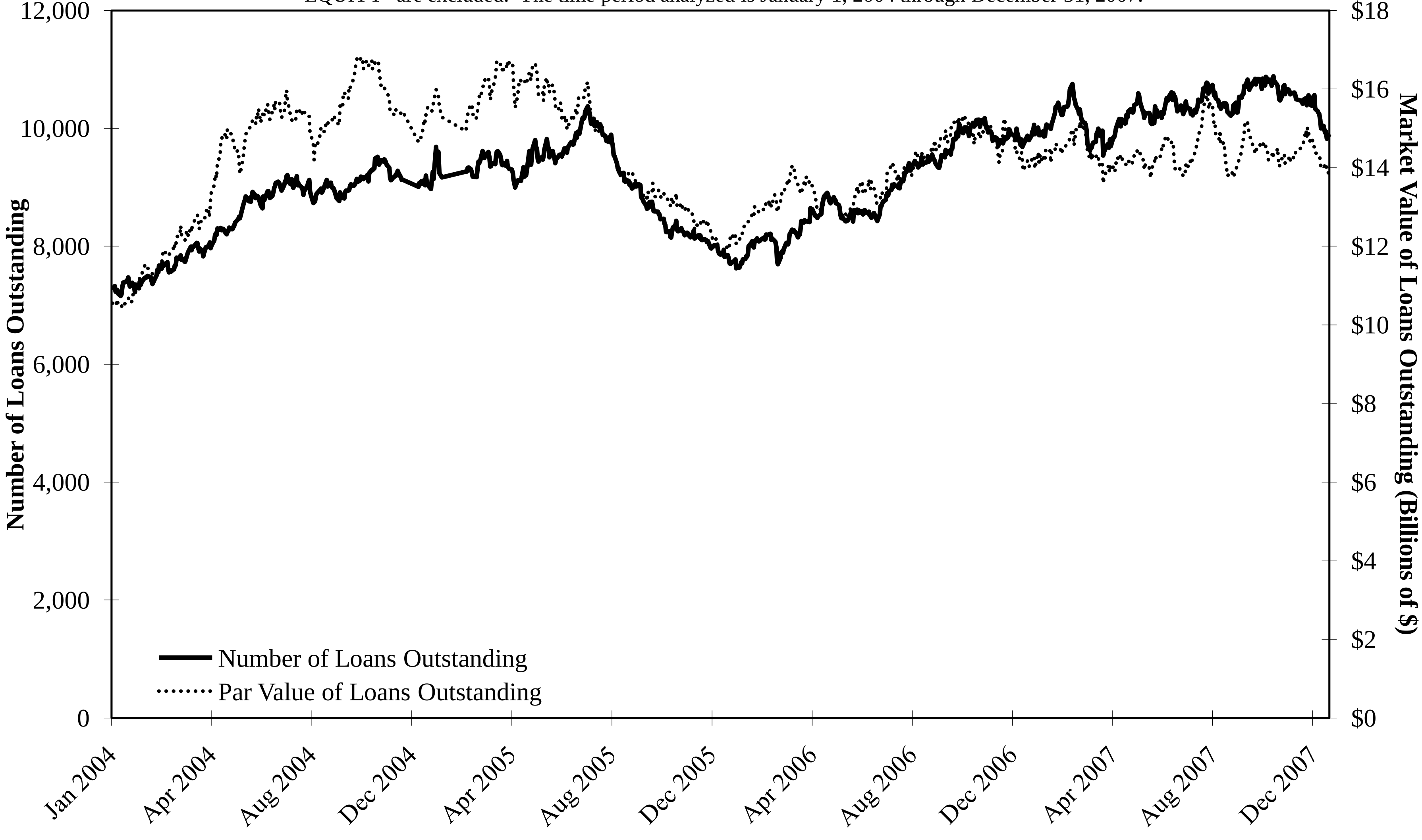

Table 2. Characteristics of Bonds in the Corporate Bond Databases

Table 2 reports bond characteristics from the FISD Corporate Bond, Proprietary Bond Inventory, and Proprietary Bond Loan databases. All ratings are S&P Ratings. Ratings data is missing for some FISD bonds. Therefore, the FISD dataset in Panel B is a subset of the overall FISD dataset in Panel A. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. Time series variables are daily averages. "Rating at Issue" is defined as the first S&P rating. For rating and rating at issue, we report the median. The treasury spread variable is available for 15,724, 8,601, and 6,034 bonds in aggregate. In 2004, it is available for 13,187, 5,960, and 3,157 bonds. In 2005, it is available for 12,879, 5,605, and 3,509 bonds. In 2006, it is available for 12,686, 5,523, and 3,835 bonds. In 2007, it is available for 12,576, 5,584, and 3,834 bonds.

Panel A: Non-rating Characteristics of Corporate Bonds

	2004 - 2007		**2004**		**2005**		**2006**		**2007**	
Number of Observations:	**FISD (57,622), Inventory (15,493), Lent (9,971)**		**FISD (37,978), Inventory (9,730), Lent (4,852)**		**FISD (40,611), Inventory (9,534), Lent (5,609)**		**FISD (43,189), Inventory (9,909), Lent (6,344)**		**FISD (44,807), Inventory (9,884), Lent (6,262)**	
	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
Size At Issue (Millions of $)										
FISD	$175.4	$325.1	$168.0	$288.6	$168.5	$296.2	$175.4	$314.0	$183.8	$339.1
Lender Inventory	$418.6	$461.1	$374.3	$408.0	$402.7	$431.7	$435.7	$460.7	$474.9	$496.5
Lent	$493.8	$484.7	$488.5	$476.8	$489.9	$475.4	$504.8	$477.5	$555.6	$518.5
Maturity at Issuance (years)										
FISD	10.7	10.1	12.5	10.5	12.3	10.4	12.0	10.5	12.1	10.7
Lender Inventory	11.3	10.1	12.0	10.1	12.1	10.3	12.0	10.7	12.4	11.1
Lent	12.0	10.2	12.0	9.3	12.1	9.6	12.2	10.4	12.8	10.9
Time Since Issuance (years)										
FISD	5.3	5.6	5.5	5.8	5.3	5.7	5.4	5.6	5.4	5.6
Lender Inventory	4.4	4.0	4.3	3.8	4.3	3.9	4.4	4.0	4.4	4.1
Lent	3.7	3.2	3.4	2.9	3.5	3.0	3.7	3.2	3.8	3.4
% Defaulted										
FISD	0.6%		0.8%		0.7%		0.6%		0.5%	
Lender Inventory	1.1%		1.4%		1.1%		1.0%		1.0%	
Lent	0.8%		0.9%		0.7%		0.7%		0.6%	
% Floating Rate										
FISD	22.3%		15.8%		17.1%		19.5%		19.5%	
Lender Inventory	17.0%		10.3%		11.5%		15.2%		16.0%	
Lent	10.4%		4.6%		6.5%		9.1%		10.0%	
% Rule 144a										
FISD	20.6%		17.0%		17.8%		19.8%		19.6%	
Lender Inventory	23.0%		16.0%		16.1%		18.1%		18.8%	
Lent	14.3%		6.2%		8.6%		10.1%		10.4%	

Panel B: Rating Characteristics of Corporate Bonds

	2004 - 2007		**2004**		**2005**		**2006**		**2007**	
Number of Observations:	**FISD (31,145), Inventory (11,897), Lent (9,025)**		**FISD (24,637), Inventory (8,487), Lent (4,559)**		**FISD (26,587), Inventory (8,156), Lent (5,284)**		**FISD (29,805), Inventory (8,319), Lent (5,954)**		**FISD (30,532), Inventory (8,396), Lent (5,841)**	
	Median / Average	Standard Deviation	Median / Average	Standard Deviation	Median / Average	Standard Deviation	Median / Average	Standard Deviation	Median / Average	Standard Deviation
Median Rating at Issue										
FISD	A		A-		A-		A		A	
Lender Inventory	BBB		BBB+		BBB+		BBB+		BBB+	
Lent	BBB		BBB+		BBB+		BBB+		BBB+	
Median Rating over Period										
FISD	A-		BBB+		A-		A-		A-	
Lender Inventory	BBB+		BBB		BBB+		BBB+		BBB+	
Lent	BBB		BBB		BBB		BBB		BBB	
% Investment Grade at Issue										
FISD	79.2%		78.1%		78.7%		79.0%		79.1%	
Lender Inventory	69.0%		72.4%		73.8%		74.5%		74.3%	
Lent	68.4%		71.5%		70.9%		71.6%		72.1%	
% Investment Grade when Lent										
FISD	70.6%		71.0%		69.0%		70.2%		72.0%	
Lender Inventory	70.7%		69.8%		69.6%		71.1%		71.3%	
Lent	64.5%		64.1%		61.5%		64.8%		66.4%	
Treasury Spread (bps)*										
FISD	178.2	181.7	170.7	181.8	179.4	184.2	185.5	185.4	191.8	185.7
Lender Inventory	178.4	155.2	163.4	145.0	156.3	133.3	155.6	130.2	161.3	130.0
Lent	165.5	138.0	148.9	119.3	147.6	116.7	152.4	123.0	157.7	123.9

Table 3. Loan Size, Loan Duration, and Changes in Loan Size

Table 3 provides descriptive statistics for the new bond loans in the Proprietary Bond Inventory and Loan databases for the overall period and by year. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. Size of New Loans is reported as the number of bonds lent. Duration of New Loan is reported as the number of days the bond is lent. New loans are only defined when we have loan data for the previous day. That is, the first day of data or the first day after missing data, there are no new loans.

Year	**2004-2007**	**2004**	**2005**	**2006**	**2007**
Number of New Loans	**367,749**	**82,119**	**88,921**	**94,320**	**102,389**
Size of New Loans (Bonds)					
Mean	1444.1	1558.5	1498.9	1411.9	1334.3
Median	350	490	453	325	250
Mode	100	100	100	100	100
10th percentile	73	85	100	60	55
25th percentile	100	100	100	100	100
75th percentile	1,435	1,600	1,554	1,436	1,066
90th percentile	4,000	4,100	4,000	3,975	3,515
Duration of New Loans (Days)					
Mean	32.7	36.2	31.6	35.4	28.4
Median	11	12	10	12	11
Mode	1	1	1	1	1
10th percentile	1	1	1	1	1
25th percentile	3	3	3	3	3
75th percentile	35	36	32	37	33
90th percentile	84	90	80	92	77
Change in Loan Size					
Percentage of loans that decrease in size	31.3%	33.5%	30.3%	32.6%	29.1%
Average total decrease in loan size (for loans that decrease)	56.8%	57.9%	58.3%	56.6%	54.7%
Average number of decreases (for loans that decrease)	1.9	1.9	1.8	2.0	1.8

Table 4. Variability of Loan Borrowing Costs

Table 4 reports the variability of loan borrowing costs from the Proprietary Bond Inventory and Loan databases for the overall period and by year. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. Loan Borrowing Costs are defined as the One-month Commercial Paper Rate minus the Rebate Rate. Loans are allocated to the year in which they are initiated, even if they extend into a second year. New loans are only defined when we have loan data for the previous day. That is, the first day of data or the first day after missing data, there are no new loans.

Year	**2004-2007**	**2004**	**2005**	**2006**	**2007**
Number of New Loans	**367,749**	**82,119**	**88,921**	**94,320**	**102,389**
Avg. # of Changes in Borrowing Costs per loan	17.2	18.5	17.3	18.0	15.4
Avg. # of Changes in Commerical Paper Rates per loan	16.2	17.4	16.6	16.9	14.2
Avg. # of Changes in Rebate Rates per loan	5.1	4.3	4.1	4.8	6.9
% of Loans with Borrowing Cost Changes	80.5%	81.9%	80.1%	80.7%	79.5%
% of Loans with Commerical Paper Rate Changes	79.9%	81.4%	79.9%	80.1%	78.6%
% of Loans with Rebate Rate Change	53.3%	48.0%	48.2%	52.8%	62.6%
% of Loans with Commercial Paper Rate Increases	75.3%	77.1%	77.0%	75.0%	72.8%
% of Loans with Commercial Paper Rate Decreases	69.4%	70.1%	63.4%	71.5%	72.2%
% of Loans with Commercial Paper Rate Increases and Decreases	64.8%	65.8%	60.5%	66.4%	66.4%
% of Loans with Rebate Rate Increases	48.9%	45.3%	46.2%	49.9%	53.4%
% of Loans with Rebate Rate Decreases	41.3%	33.0%	28.7%	43.7%	56.5%
% of Loans with Rebate Rate Increases and Decreases	36.9%	30.4%	26.6%	40.9%	47.3%

Table 5. Distribution of New Loan Borrowing Costs

Table 5, Panel A reports the borrowing costs on new loans over time, equal-weighted by loan (EW) and value-weighted by loan size (VW). Panel B presents borrowing costs over time partioned by loan size. Data is from the Proprietary Bond Loan database for the overall period and by year. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. Loan Borrowing Costs are defined as the One-month Commercial Paper Rate minus the Rebate Rate. Loans are allocated to the year in which they are initiated, even if they extend into a second year. New loans are only defined when we have loan data for the previous day. That is, the first day of data or the first day after missing data, there are no new loans.

Panel A: Borrowing Costs Equally Weighted by Loan (EW) and Weighted by Par Value of Loan (VW)

Year	**2004-2007**		**2004**		**2005**		**2006**		**2007**	
Number of New Loans	**367,749**		**82,119**		**88,921**		**94,320**		**102,389**	
	EW	**VW**	**EW**	**VW**	**EW**	**VW**	**EW**	**VW**	**EW**	**VW**
Mean	0.33	0.22	0.37	0.22	0.45	0.28	0.32	0.26	0.19	0.13
Median	0.18	0.14	0.31	0.16	0.49	0.18	0.16	0.14	0.13	0.08
Mode	0.13	0.13	0.51	0.51	0.49	0.49	0.13	0.13	0.13	0.13
10th percentile	0.07	0.04	0.11	0.08	0.12	0.07	0.08	0.04	-0.05	-0.03
25th percentile	0.12	0.09	0.15	0.14	0.18	0.13	0.12	0.09	0.08	0.03
75th percentile	0.51	0.23	0.53	0.25	0.59	0.28	0.48	0.22	0.17	0.14
90th percentile	0.64	0.40	0.67	0.39	0.72	0.53	0.58	0.48	0.49	0.26

Panel B: Borrowing Costs by Loan Size

Year	**2004-2007**		**2004**		**2005**		**2006**		**2007**	
Number of Loans	**109,124**	**258,625**	**23,127**	**58,992**	**24,067**	**64,854**	**27,126**	**67,194**	**34,804**	**67,585**
	≤100	**>100**	**≤100**	**>100**	**≤100**	**>100**	**≤100**	**>100**	**≤100**	**>100**
Mean	0.39	0.30	0.51	0.31	0.63	0.39	0.33	0.31	0.19	0.19
Median	0.48	0.16	0.52	0.22	0.56	0.27	0.20	0.15	0.13	0.13
Mode	0.13	0.13	0.51	0.51	0.49	0.14	0.13	0.13	0.13	0.13
10th percentile	0.09	0.06	0.12	0.11	0.25	0.11	0.09	0.08	0.03	-0.01
25th percentile	0.13	0.12	0.50	0.15	0.50	0.16	0.13	0.12	0.09	0.06
75th percentile	0.54	0.49	0.65	0.51	0.67	0.54	0.50	0.35	0.22	0.15
90th percentile	0.69	0.59	0.76	0.58	0.74	0.69	0.61	0.56	0.50	0.49

Figure 2. Equally-Weighted Monthly Distribution of Loan Borrowing Costs

Figure 2 plots the equally-weighted borrowing cost quintiles monthly from theProprietary Bond Inventory and Loan databases over time. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007.

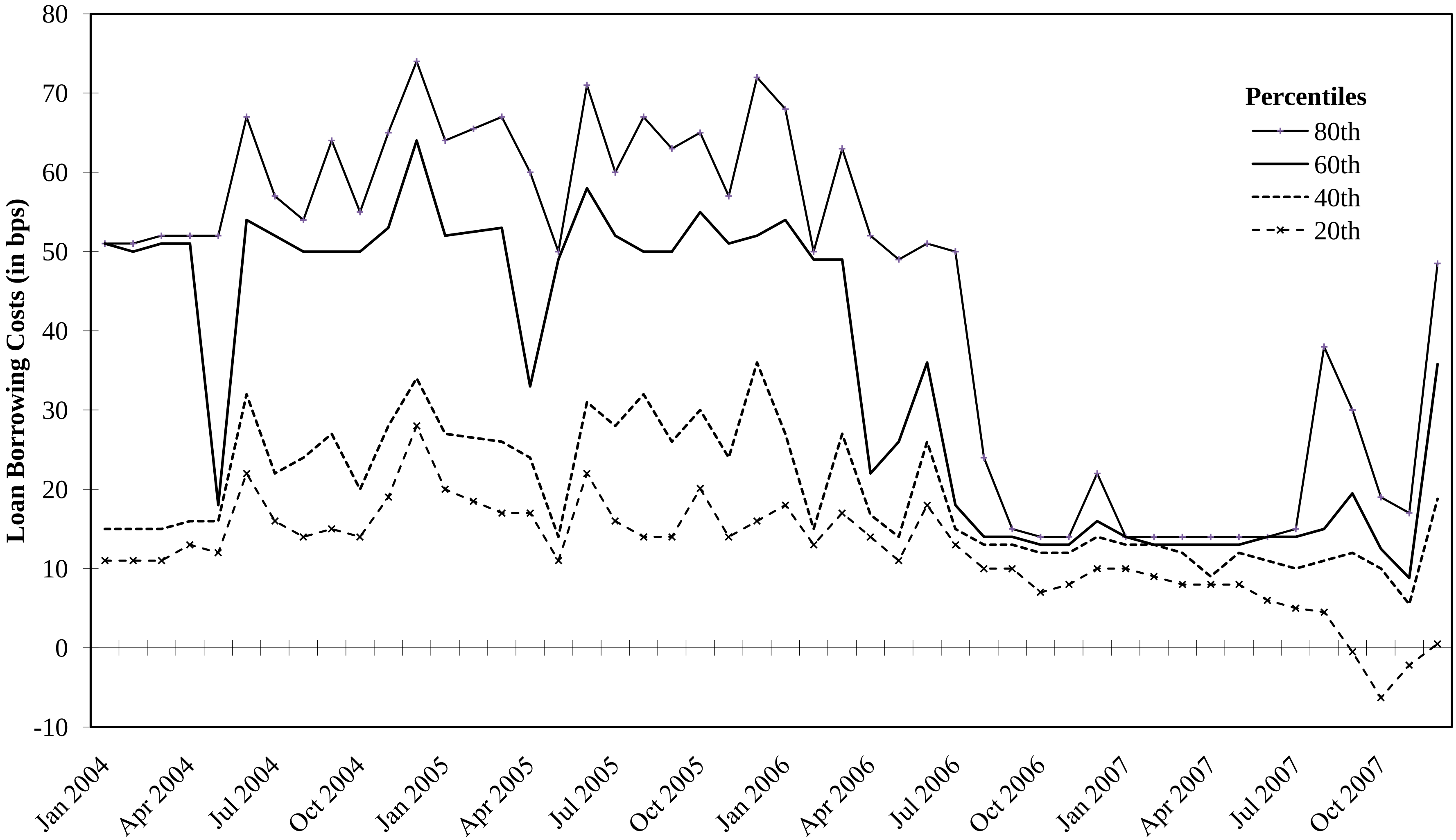

Figure 3. Unweighted Distribution of Loan Borrowing Costs

Figure 3 plots histograms of equally-weighted borrowing costs pre- and post- April 2006. Data is from the Proprietary Bond Inventory and Loan databases over time. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. Loans with negative borrowing costs are not included and loans with borrowing costs greater than 100 basis points are capped at 100.

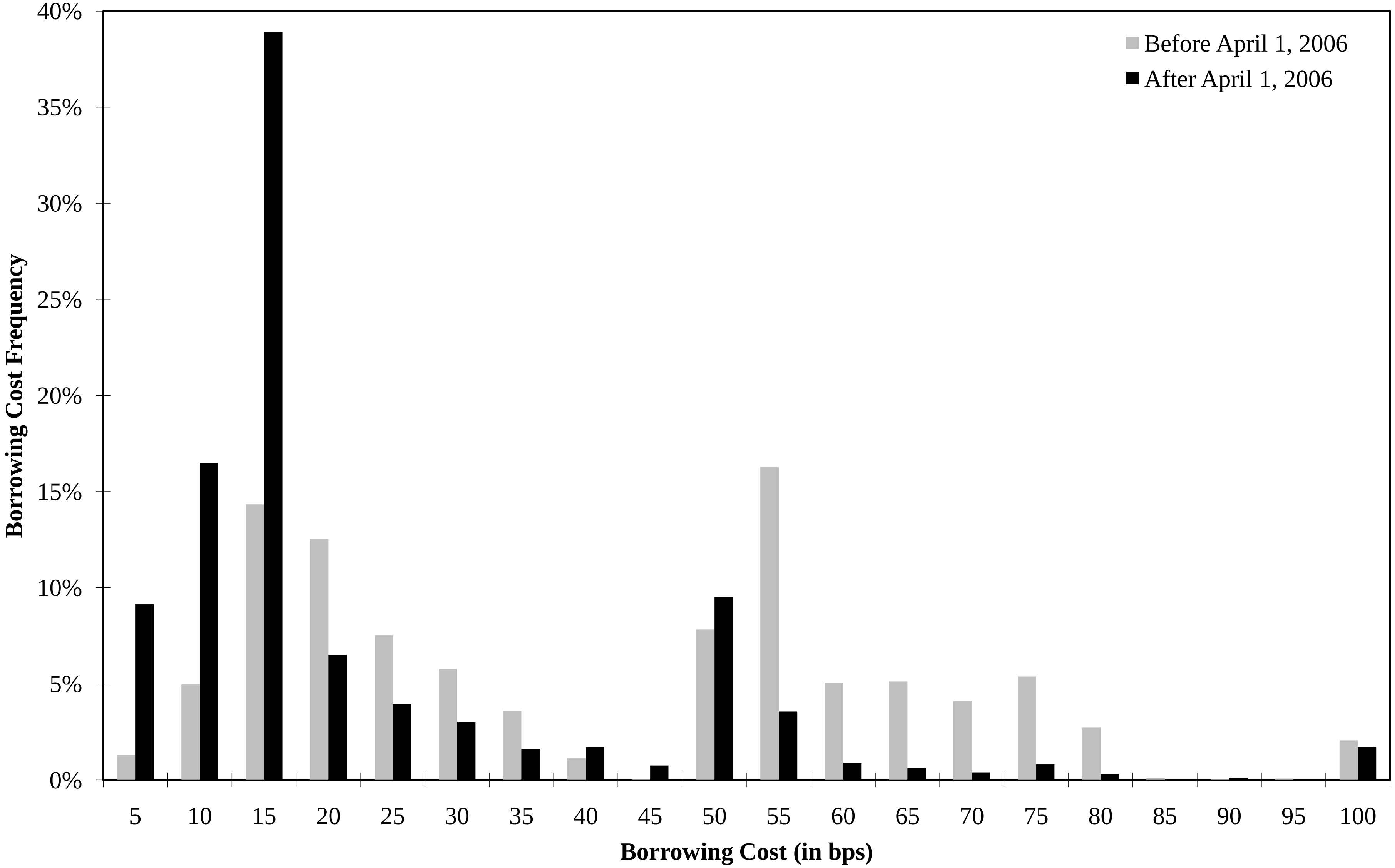

Figure 4. Relationship Between Borrowing Cost and Percent of Inventory On Loan

Figure 4 plots the relationship between the average borrowing cost and the amount of inventory on loan for the period April 2005 to December 2007 and for several sub-periods. Data is from the Proprietary Bond Inventory and Loan databases over time. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded.

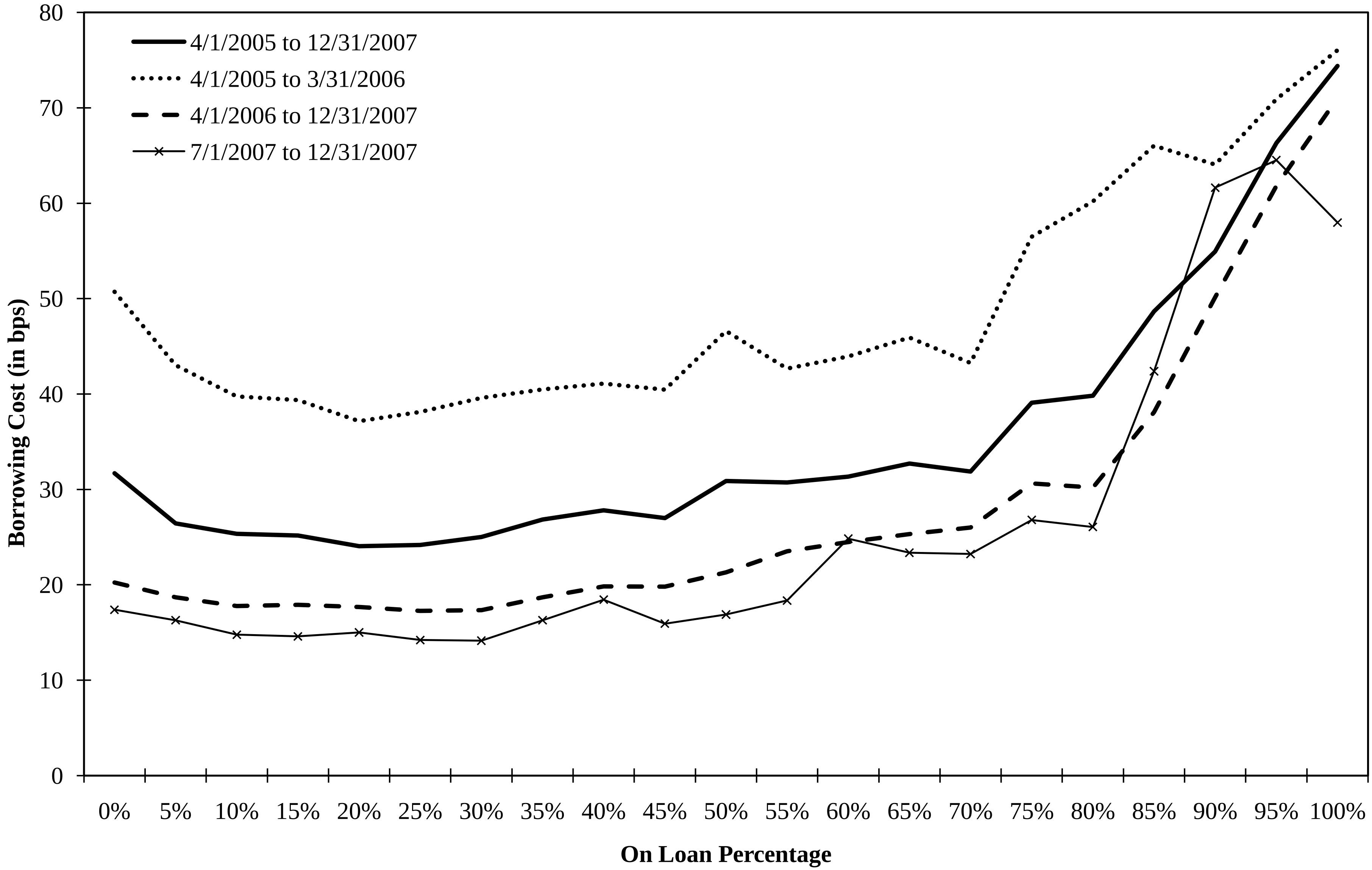

Table 6. Corporate Bonds with the Highest Borrowing Costs

Table 6 presents the 35 corporate bonds with the highest borrowing costs in our sample. Data is from the Proprietary Bond Loan database for the overall period and by year. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. Each bond is listed once with corresponding date, rebate rate, maximum loan borrowing cost, and on loan percentage. Number of Bonds is the number of bonds issued by a given firm that ever had borrowing costs greater than the 100th most expensive to borrow bond in our sample.

CUSIP	Issuing Company Name	Date	Rebate Rate (in bps)	Borrowing Cost (in bps)	On Loan %	Number of Bonds
13134VAA1	CALPINE CDA ENERGY FIN ULC	5/10/06	-10.00	15.01	100.0%	1
131347AW6	CALPINE CORP	2/15/06	-10.00	14.50	75.9%	8
26632QAK9	DURA OPER CORP	2/28/07	-7.00	12.23	21.6%	2
247126AC9	DELPHI AUTOMOTIVE SYS CORP	2/2/06	-7.00	11.50	51.6%	4
07556QAN5	BEAZER HOMES USA INC	10/31/07	-4.79	9.32	100.0%	2
45661YAA8	INEOS GROUP HLDGS PLC	10/31/07	-4.79	9.32	65.3%	1
729136AF8	PLIANT CORP	10/31/07	-4.79	9.32	100.0%	2
909279AW1	UNITED AIR LINES INC	12/13/05	-5.00	9.27	90.2%	1
256605AD8	DOLE FOOD INC	10/31/07	-4.13	8.66	38.8%	1
800907AK3	SANMINA - SCI CORP	10/31/07	-4.00	8.53	76.7%	2
15101QAC2	CELESTICA INC	10/31/07	-4.00	8.53	100.0%	1
194832AD3	COLLINS & AIKMAN PRODS CO	6/23/06	-3.00	8.24	99.5%	2
001765AU0	AMR CORP DEL	3/5/07	-2.50	7.75	73.1%	1
370442BT1	GENERAL MTRS CORP	10/31/07	-2.88	7.41	88.3%	4
35687MAP2	FREESCALE SEMICONDUCTOR INC	9/6/07	-2.00	7.28	84.3%	1
984756AD8	YANKEE ACQUISITION CORP	8/7/07	-2.00	7.28	100.0%	2
85375CAK7	STANDARD PAC CORP NEW	10/31/07	-2.00	6.53	100.0%	3
978093AE2	WOLVERINE TUBE INC	2/1/06	-2.00	6.48	64.3%	1
624581AB0	MOVIE GALLERY INC	10/24/06	-1.00	6.25	34.7%	1
256669AD4	DOLLAR GEN CORP	10/16/07	-1.00	5.83	99.9%	1
179584AG2	CLAIRES STORES INC	12/26/07	-0.75	5.39	99.0%	2
767754AD6	RITE AID CORP	8/2/06	0.00	5.32	10.7%	1
156503AH7	CENTURY COMMUNICATIONS CORP	7/31/06	0.00	5.31	73.2%	2
373200AT1	GEORGIA GULF CORP	9/11/07	0.00	5.31	100.0%	2
667281AM1	NORTHWEST AIRLS INC	8/1/06	0.00	5.31	80.0%	2
640204AH6	NEIMAN MARCUS GROUP INC	7/18/06	0.00	5.30	97.2%	1
75040KAC3	RADIOLOGIX INC	7/18/06	0.00	5.30	98.8%	1
651715AD6	NEWPAGE CORP	7/27/06	0.00	5.30	84.7%	1
872962AD7	TECHNICAL OLYMPIC USA INC	6/26/07	0.00	5.30	100.0%	1
247361XY9	DELTA AIR LINES INC DEL	7/17/06	0.00	5.29	99.7%	3
667280AF8	NORTHWEST AIRLS INC	8/3/06	0.00	5.29	100.0%	2
420029AD2	HAWAIIAN TELCOM COMMUNICATIONS	7/26/06	0.00	5.29	82.8%	4
721467AF5	PILGRIMS PRIDE CORP	8/7/07	0.00	5.28	99.8%	2
87971KAA5	TEMBEC INDS INC	12/12/06	0.00	5.28	14.3%	1
79546VAF3	SALLY HLDGS LLC / SALLY CAP INC	9/6/07	0.00	5.28	85.0%	2
303901AN2	FAIRFAX FINL HLDGS LTD	6/29/06	0.00	5.27	96.5%	4

Table 7. Regression Analysis of Determinants of Borrowing Costs

Table 7 reports estimates of the following equation:

$$\text{Borrowing Cost}_{ibt} = \beta_1\text{*OnLoan\%}_{bt} + \beta_2\text{*loan size}_i + \beta_3\text{*rating}_{bt} + \beta_4\text{*issue size}_b + \beta_5\text{*time since issue}_{bt} + \beta_6\text{*floating rate}_b + \beta_7\text{*rule144a}_b +$$

where CPrate is the one month financial commercial paper rate (in our model 100 bps = 1.00); RR is the rebate rate (with the same scale as the CPrate); OnLoan% is the percentage of daily inventory lent; Loan Size is the total number of bonds lent in thousands of bonds (that is, the loan value in $ millions); Rating is the S&P bond rating at the time of the loan where AAA is given a value of 1 and D is given a value of 22. (All intermediate ratings are given consecutive values between 1 and 22). Issue Size is the size of the initial bond offering (in $ millions); Time Since Issue is the time since the bond was issued (in years); Floating Rate is a dummy equal to 1 if the bond pays a floating rate coupon and 0 if the bond has a fixed rate coupon; Rule 144a is a dummy equal to 1 if the bond was issued under SEC rule 144a and 0 otherwise; the δ variables are a set of dummies for each trading day in our sample; the κ variables are a set of dummies for each bond cusip in our sample; and the λ variables are a set of dummies for each prime broker in our sample who borrows 100 or more times during our sample period. Subscripts i, b, and t correspond to loan i, bond b, and day t. There are 65 prime brokers that borrow from the lender during our sample period, 40 make 100 or more loans and 25 make less than 100 loans. The average number of loans for the largest 40 is 9,178 and the average number for the smallest 25 is 25. Standard errors are heteroskedasticity-robust and t-statistics are reported in parenthesis. The data is from the FISD Corporate Bond, Proprietary Bond Inventory, and Proprietary Bond Loan databases. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. * one-tailed probability < 0.10; ** one-tailed probability < 0.05; *** one-tailed probability < 0.01.

	[1]	[2]	[3]	[4]
On Loan %	0.2956 ***	0.2923 ***	0.0411 ***	0.0524 ***
	(46.29)	(46.69)	(6.70)	(8.70)
Loan Size (thousands)	-0.0201 ***	-0.0164 ***	-0.0150 ***	-0.0123 ***
	(-42.26)	(-33.85)	(-41.27)	(-33.69)
Bond Rating	0.0124 ***	0.0153 ***	0.0368 ***	0.0362 ***
(where AAA=1, …, D=22)	(34.17)	(38.65)	(15.19)	(15.13)
Bond Issue Size ($100M)	0.0034 ***	0.0035 ***		
	(18.92)	(19.91)		
Bond Time Since Issuance	0.0069 ***	0.0066 ***		
(years)	(13.04)	(12.71)		
Bond Floating	-0.0613 ***	-0.0599 ***		
	(-13.75)	(-13.52)		
Bond Rule 144a	0.0217 ***	0.0182 **		
	(2.70)	(2.26)		
Broker Dummies	N	Y	N	Y
CUSIP Dummies	N	N	Y	Y
Broker effects				
F-test	n/a	F = 690.88 ***	n/a	F = 847.82 ***
p-value	n/a	p < 0.0001	n/a	p < 0.0001
max - min	n/a	0.6115 ***	n/a	0.5818 ***
p-value		p < 0.0010		p < 0.0010
p_75-p_25	n/a	0.2182 ***	n/a	0.1928 ***
p-value		p < 0.0010		p < 0.0010
R^2	0.3520	0.3904	0.5678	0.5891
N	195,406	195,406	195,406	195,406

Table 8. Competitive Races between Brokers

Table 8 uses data from the Proprietary Bond Loan databases and compares broker borrowing costs by examining all days where two or more borrowers borrow the same bond. 26 identified brokers have at least 100 competitive races. Success of Individual Brokers in 2 Broker and 3+ Broker Competitive Races is defined as having the lowest borrowing cost for a new loan in the same bond on the same day. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007. * indicates Percentage of Wins that are significantly different than 50% and 33.33% at 0.01 one tailed probability for 2 and 3+ brokers, respectively.

				2 Broker		3+ Broker	
Broker ID	# of Loans	# of Bonds Borrowed	Total Lending Fees Paid	# Competitive Races / Wins	Percentage of Wins	# Competitive Races / Wins	Percentage of Wins
A	40,994	41,714,394	$13,090,277	6,478 / 5,993	92.5% *	1,561 / 1,231	78.9% *
B	2,595	2,075,390	$63,271	546 / 479	87.7% *	164 / 127	77.4% *
C	12,773	42,175,029	$6,994,331	1,780 / 1,423	79.9% *	719 / 476	66.2% *
D	5,816	24,283,893	$7,006,490	790 / 622	78.7% *	361 / 239	66.2% *
E	11,132	28,620,944	$4,632,767	1,668 / 1,261	75.6% *	574 / 328	57.1% *
F	1,755	7,944,398	$2,764,846	257 / 189	73.5% *	118 / 59	50.0% *
G	4,190	12,189,596	$3,043,453	556 / 406	73.0% *	252 / 151	59.9% *
H	35,258	90,905,175	$22,738,674	3,444 / 2,128	61.8% *	1,246 / 534	42.9% *
I	972	2,639,919	$189,152	125 / 76	60.8%	55 / 25	45.5%
J	2,209	5,404,871	$1,420,770	345 / 194	56.2%	129 / 46	35.7%
K	3,767	11,597,273	$9,623,957	366 / 195	53.3%	183 / 68	37.2%
L	3,011	8,902,543	$2,063,986	399 / 206	51.6%	184 / 77	41.8%
M	11,762	26,925,386	$3,697,178	1,444 / 695	48.1%	584 / 226	38.7%
N	21,355	38,973,071	$10,798,318	2,323 / 976	42.0%	861 / 332	38.6%
O	5,428	6,060,740	$1,565,975	503 / 177	35.2%	195 / 50	25.6%
P	87,612	84,174,639	$40,545,662	6,992 / 2,399	34.3%	2,057 / 519	25.2%
Q	6,633	18,783,575	$7,711,792	645 / 217	33.6%	318 / 83	26.1%
R	14,339	23,432,851	$15,138,170	1,404 / 403	28.7%	607 / 144	23.7%
S	43,344	22,503,842	$4,825,499	2,951 / 839	28.4%	1,109 / 241	21.7%
T	2,662	1,787,228	$260,718	287 / 41	14.3%	136 / 19	14.0%
U	2,244	535,303	$88,309	237 / 29	12.2%	139 / 4	2.9%
V	10,638	3,875,297	$858,456	996 / 113	11.3%	395 / 25	6.3%
W	14,407	5,641,386	$1,195,550	1,464 / 94	6.4%	442 / 26	5.9%
X	2,646	1,213,004	$253,763	309 / 19	6.1%	136 / 4	2.9%
Y	3,460	1,323,795	$272,237	518 / 24	4.6%	175 / 11	6.3%
Z	11,813	5,726,357	$1,701,179	1,577 / 54	3.4%	458 / 29	6.3%
Remainder	4,934	11,640,326	4,764,471	682 / 291	40.6%	259 / 93	35.9%

Figure 5. Borrowing Costs Around Bankruptcies

Figure 5 plots borrowing costs around bankruptcy filings. Data is from the Proprietary Bond Inventory and Loan databases over time. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. There are 212 bonds in the inventory database of corporate bonds involved in a bankruptcy, representing 90 unique bankruptcies. However, only 69 bonds have any lending activity (either new or existing loans) during the period from 30 trading days before until 30 trading days after the bankruptcy, which corresponds to 39 unique bankruptcies.

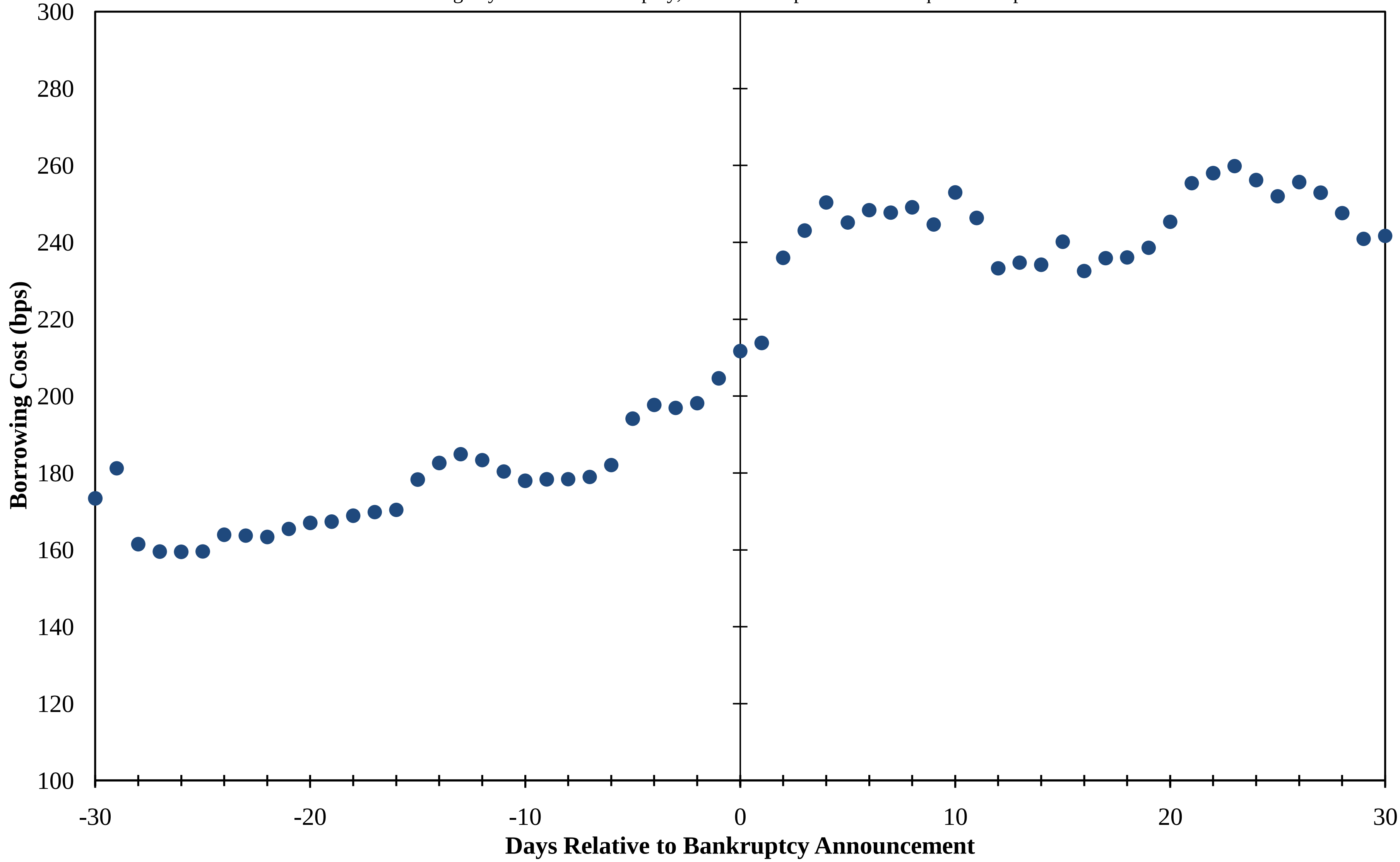

Figure 6. Borrowing Costs Around Credit Events

Figure 6 plots borrowing costs around credit rating changes. Data is from the Proprietary Bond Inventory and Loan databases over time. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. We define a large credit rating change as a movement of three or more S&P ratings, or one full letter or more, e.g. going from an A+ to a B+ or from a BB- to an AA-. There are 296 full-letter upgrade events on bonds in the inventory database, which correspond to 284 unique bonds. Our data covers 128 of these events, which correspond to 125 unique bonds. There are 392 full-letter downgrade events during our time period on 367 unique bonds. Our data covers 210 of these events on 197 bonds.

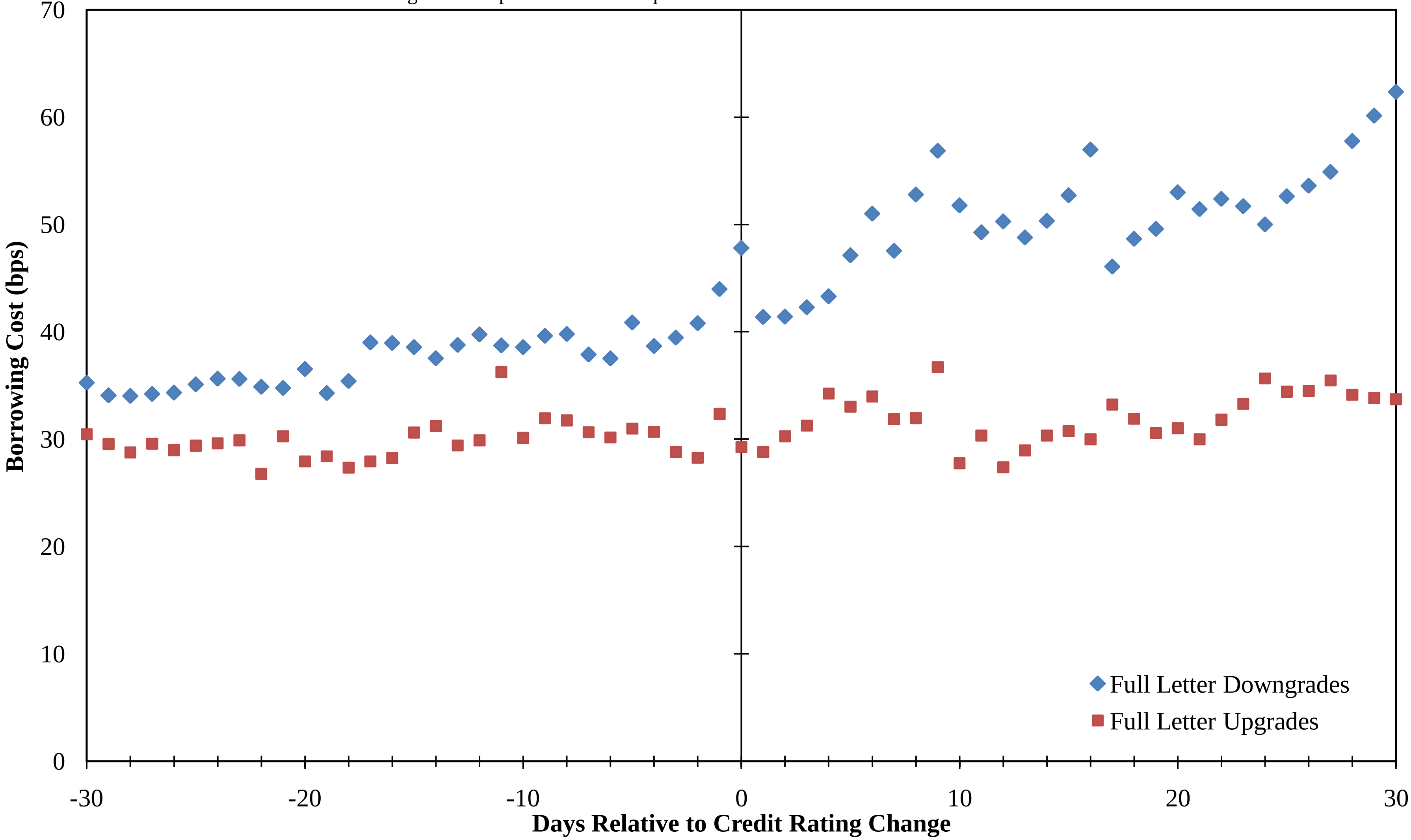

Table 9. Monthly Returns to Long Bond Portfolio Positions

Table 9 uses the TRACE database and computes returns for portfolios of bonds that are borrowed. Unweighted and weighted returns are computed for each month, both raw and excess (net of TRACE). Portfolio quintiles are calculated at the beginning of each period based on the set of bonds that go on loan in that period. Unweighted raw returns are the unweighted average of (end of period sell - start of period buy + coupons paid + change in accrued interest) / (start of period buy + initial accrued interest). Unweighted excess returns are the unweighted average of raw returns minus the TRACE portfolio return. The TRACE portfolio return is the return from holding a portfolio of all bonds in TRACE. The weighted raw are the offering-size weighted average of raw returns. Weighted excess returns subtract the weighted TRACE portfolio return. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007.

Panel A: Bond Portfolios Which Are Formed According To Borrowing Cost

	# of Bonds in Portfolio	# of Bonds with TRACE Coverage in All Months	Equally-weighted Raw Returns		Value-weighted Raw Returns		Equally-weighted Excess Returns (Net of TRACE)		Value-weighted Excess Returns (Net of TRACE)	
Portfolio	Mean	Mean	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
All New Loans	2360.8	1937.3	0.40%	0.97%	0.42%	0.88%	-0.06%	0.40%	0.00%	0.20%
1st Quintile	536.0	432.2	0.40%	1.03%	0.43%	0.91%	-0.05%	0.46%	0.00%	0.25%
2nd Quintile	469.6	373.3	0.39%	1.00%	0.44%	0.90%	-0.04%	0.42%	0.01%	0.25%
3rd Quintile	509.7	417.3	0.38%	0.94%	0.39%	0.90%	-0.09%	0.41%	-0.03%	0.23%
4th Quintile	442.1	372.4	0.40%	0.93%	0.37%	0.85%	-0.10%	0.44%	-0.03%	0.23%
5th Quintile	403.5	342.1	0.45%	1.04%	0.45%	0.92%	-0.03%	0.50%	0.02%	0.32%
95th Percentile	163.3	134.0	0.49%	1.43%	0.54%	1.35%	0.07%	0.96%	0.12%	0.92%
99th Percentile	26.4	19.5	0.81%	3.70%	1.09%	4.66%	0.33%	3.39%	0.67%	4.49%

Panel B: Bond Portfolios Which Are Formed According To Percent of Inventory On Loan

	# of Bonds in Portfolio	# of Bonds with TRACE Coverage in All Months	Equally-weighted Raw Returns		Value-Weighted Raw Returns		Equally-weighted Excess Returns (Net of TRACE)		Value-Weighted Excess Returns (Net of TRACE)	
Portfolio	Mean	Mean	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Not Lent	5013.5	2573.8	0.40%	0.70%	0.34%	0.64%	-0.04%	0.32%	-0.04%	0.15%
Lent	2821.5	2246.9	0.40%	0.98%	0.39%	0.94%	-0.04%	0.39%	0.00%	0.20%
1st Quintile	564.8	478.4	0.37%	0.92%	0.36%	0.89%	-0.07%	0.48%	-0.03%	0.29%
2nd Quintile	564.3	466.8	0.39%	0.93%	0.38%	0.91%	-0.05%	0.43%	-0.01%	0.25%
3rd Quintile	564.3	454.1	0.40%	0.99%	0.38%	1.00%	-0.05%	0.43%	0.00%	0.30%
4th Quintile	564.3	442.0	0.41%	1.03%	0.38%	0.99%	-0.03%	0.46%	0.00%	0.28%
5th Quintile	563.9	405.6	0.47%	1.32%	0.46%	1.25%	0.03%	0.82%	0.07%	0.79%
95th Percentile	141.5	93.9	0.44%	1.97%	0.45%	1.94%	0.00%	1.68%	0.06%	1.70%
99th Percentile	57.7	35.4	0.37%	2.38%	0.41%	2.54%	-0.07%	2.21%	0.03%	2.42%

Table 10. Bond and Stock Borrowing Relationship

Table 10 examines differences in borrowing costs between corporate bonds and matched equity. Data is from the Proprietary Bond Loan and Equity databases for the overall period and by year. Only bonds that can be matched to a unique equity issue for a given loan and date were included. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007.

	2004-2007	**2004**	**2005**	**2006**	**2007**
N	**109,282**	**25,820**	**27,401**	**27,710**	**28,351**
% bond > stock	32.14%	37.34%	40.40%	28.06%	23.42%
% bond = stock	0.16%	0.16%	0.16%	0.11%	0.20%
% bond < stock	67.70%	62.50%	59.44%	71.83%	76.37%
% bond and stocks within +/- 10 bps	60.08%	57.66%	50.15%	63.03%	69.00%
% bond > stock by more than 10 bps	26.25%	34.88%	39.12%	20.56%	11.52%
# bond > 100 bps	1,349	173	572	369	235
% of all matched loans	1.23%	0.67%	2.09%	1.33%	0.83%
# stocks > 100 bps	6,809	851	1,435	2,131	2,392
% of all matched loans	6.23%	3.30%	5.24%	7.69%	8.44%
if bond > 100 bps, % stock > 100 bps	12.97%	16.18%	10.49%	14.63%	14.04%
if stock > 100 bps, % bond > 100 bps	2.57%	3.29%	4.18%	2.53%	1.38%
# bond > 75 bps	3,419	1,120	1,313	632	354
% of all matched loans	3.13%	4.34%	4.79%	2.28%	1.25%
# stock > 75 bps	7,364	1,149	1,514	2,214	2,487
% of all matched loans	6.74%	4.45%	5.53%	7.99%	8.77%
if bond > 75 bps, % stock > 75 bps	9.77%	8.39%	8.45%	12.18%	14.69%
if stock > 75 bps, % bond > 75 bps	4.54%	8.18%	7.33%	3.48%	2.09%

Figure 7: Bond and Stock Borrowing Cost Differences

Figure 7 examines differences in borrowing costs between corporate bonds and matched equity. Data is from the Proprietary Bond Loan and Equity databases for the overall period and by year. Only bonds that can be matched to a unique equity issue for a given loan and date were included. Convertibles, exchangeables, unit deals, perpetual bonds, bonds with missing or nonsensical offering amount data, and all bonds with "KNOCK", "REVERSE", or "EQUITY" are excluded. The time period analyzed is January 1, 2004 through December 31, 2007.