Corporate Bond Illiquidity: Evidence from Government Guarantees

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ABSTRACT

We use a unique set of corporate bonds guaranteed by the full faith and credit of the U.S. to examine the default- and nondefault-related components in corporate bond spreads. Based on a matched sample of guaranteed and non-guaranteed corporate bonds, we find that 16% of the yield spread between investment grade corporate bonds and Treasury securities is not accounted for by government credit guarantees. Our estimate of the non-default component differs from the bond-CDS basis, suggesting that not only corporate bond spreads but also CDS spreads depend on non-default factors. Its magnitude is determined by the provision of dealer intermediation as well as bond-specific characteristics such as time to maturity and issue size.

JEL classification: G12, G18.

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Most corporate bonds are traded in dealer networks that are relatively thin and may involve significant price uncertainty and transaction costs. Credit risk is therefore not the only factor that determines the yield spread on corporate bonds over Treasuries. In fact, Elton, Gruber, Agrawal, and Mann (2001) and Huang and Huang (2012) find that credit risk accounts for a surprisingly small fraction of the yield spread for investment grade bonds, with the fraction lower for bonds of shorter maturities – a finding sometimes referred to as the "credit spread puzzle." Illiquidity is thought to be a major factor contributing to the corporate–Treasury spread, and its implications for corporate bond prices are examined in a number of studies.[1] However, the size of the liquidity contribution and the factors that determine its magnitude are difficult to establish, not least because corporate bond liquidity is typically intertwined with credit risk. Corporate bonds with higher credit risk tend to be less liquid and illiquidity tends to rise in times of heightened uncertainty about the issuers' credit quality. Corporate default decisions also interact with bond liquidity via the rollover channel (He and Milbradt (2014), Chen, Cui, He, and Milbradt (2018)). Less liquid bond market conditions make it more difficult for firms to roll over their maturiing debt, raising the possibility of default-liquidity spirals. In addition to liquidity, the observed corporate–Treasury yield spreads may reflect other factors such as the asymmetric tax treatment of corporate and Treasury bonds and call or conversion features.

In this paper, we examine the determinants of liquidity spreads and their magnitude in a sample of corporate bonds that are free of credit risk because they are backed by U.S. Government guarantees. Specifically, the sample is made up of corporate bonds issued under the Temporary Liquidity Guaranteed Program (TLGP) between December 2008 and June 2009. These bonds have similar liquidity characteristics as risky corporate bonds: they are issued by the same corporations and traded in the same dealer networks. They also have the same tax treatment as other corporate bonds, and are at the shorter-end of the maturity spectrum where the credit spread puzzle is most pronounced. However, their performance, including the timely payment of all principal and interest, is guaranteed by the full faith and credit of the United States.[2] This separation of liquidity and credit risk allows us to analyze liquidity in the cross-section of corporate bonds and over time without the confounding effects of credit risk.

Using a matched sample of guaranteed and non-guaranteed bonds issued by TLGP program participants, we measure the credit risk component as the portion of the bond spread that is attributable to the credit guarantee, that is, the difference between the spreads on

[1] Important examples include Longstaff, Mithal, and Neis (2005), Covitz and Downing (2007), Chen, Lesmond, and Wei (2007), Bao, Pan, and Wang (2011), Dick-Nielsen, Feldhütter, and Lando (2012).

[2] TLGP bonds were backed by the full faith and credit of the United States pursuant to section 15(d) of the Federal Deposit Insurance Act.

otherwise comparable bonds that differ only in their credit guarantee. The liquidity component is measured by TLGP bond spread over comparable maturity Treasury securities after adjusting for differences in state income tax treatment between Treasury and corporate bonds.

Based on the matched sample, we estimate that governement guarantees on average explain 84% of the yield spread between investment grade corporate bonds and comparable maturity Treasury securities. Credit risk is thus the most important determinant of corporate bond spreads, even for high quality issuers and bonds with shorter maturities that constitute most of the sample firms. Illiquidity accounts on average for 12% of the corporate bond spread, while state income taxes account for 4%. Illiquidity discounts are higher during the financial crisis period, accounting for 20% of the corporate bond spread. We also compare our estimate of the illiquidity spread with the bond-CDS basis, and find that the bond-CDS basis is much more volatile and frequently smaller in magnitude than the illiquidity component in corporate bonds. Notably, the bond-CDS basis falls short of the liquidity component during the European debt crisis in late 2011 when many sellers of CDS protection on U.S. banks were facing tighter balance sheet constaints. These findings imply that not only the prices of corporate bonds but also those of credit default swaps depend on non-default factors. Therefore, the bond-CDS basis may either overestimate or underestimate the illiquidity component in corporate bond spreads.

We further analyze the sample of guaranteed bonds to examine what factors, besides the issuer's credit risk, determine spreads for corporate bonds. We employ a comprehensive dataset on the microstructure of the corporate bond market to study the importance of factors such as dealer intermediation, institutional ownership, trading activity, issue size, and other liquidity proxies for corporate bond spreads.[3] Our findings highlight the importance of dealer intermediation. Consistent with the predictions of Duffie, Gârleanu, and Pedersen (2005), we find that a greater number of dealers and larger dealer inventories are associated with lower liquidity spreads, reflecting investors' ability to negotiate better transactions prices. However, we do not find support for the hypothesis that the institutional investor base affects corporate bond prices. Neither the number of institutional investors nor the amount of their holdings is significantly associated with spreads. Overall, these findings show that the provision of dealer intermediation is among the most imporant determinants of corporate bond spreads.

In addition, larger illiquidity discounts in the sample of guaranteed bonds are associated

[3] We use a confidential version of the Trade Reporting and Compliance Engine (TRACE) which includes all trade reports (both disseminated and non-disseminated), dealer identifiers, as well as the exact trading volume.

with characteristics such as longer bond maturities, smaller bond sizes, and wider bid-ask spreads. The coefficient estimates from regressions of TLGP bond spreads on liquidity proxies typically have an intuitive sign and magnitude. In contrast, if we examine the sample of non-guaranteed bonds, we find that the coefficients on several liquidity proxies are biased. For example, the effect of bid-ask spreads on illiquidity discounts is overestimated by a factor of seven, reflecting the positive correlation between bid-ask spreads and issuer credit risk. Meanwhile, the effect of dealer intermediation is underestimated due to dealer risk aversion and risk sharing in the dealer community. Importantly, illiquidity discounts are not associated with credit risk proxies such as the issuer's CDS spread in the sample of guaranteed bonds, although they are positively associated with credit risk in the sample of risky bonds, suggesting that our approach provides an accurate identification of the liquidity and credit risk components in corporate bond spreads.

Our approach is similar to that of Longstaff (2004) who examines liquidity premia in Treasury bond prices by comparing Treasury bond prices with prices of bonds issued by Refcorp, a U.S. Governement agency. We use a similar methodology to study corporate bonds that are guaranteed by the full faith and credit of the U.S. However, rather than focus on agency securities that closely resemble Treasuries in their liquidity and trading, our study examines corporate bonds – specifically investment-grade bonds at the short end of the maturity spectrum where the credit spread puzzle is most pronounced. Our sample period from 2008 to 2012 includes the recent financial crisis, allowing us to assess the magnitude of liquidity and credit risk effects on corporate bond spreads in normal times as well as in times of market stress. Our paper is also related to previous work by Lewis, Longstaff, and Petrasek (2017) who examine TLGP bonds to test a number of theories about why asset prices may diverge from fundamental values. We extend this research by analyzing a matched sample of guaranteed and non-guarateed bonds to gauge the importance of liquidity and credit risk for corporate bond spreads.

The estimates of the magnitude of the illiquidity component in spreads for investment-grade bonds vary significantly among previous studies, ranging from a few basis points in Longstaff et al. (2005), Dick-Nielsen et al. (2012), and Feldhütter and Schaefer (2018) to most of yield spreads in Chen et al. (2007) and Huang and Huang (2012). Longstaff et al. (2005) use the information in credit default swaps to measure of the size of the default and nondefault components in corporate spreads. Their finding that the majority of the corporate bond spread is due to default risk is consistent with ours. However, when we compare the magnitude of the liquidity spread derived from guaranteed corporate bonds with the Longstaff et al. (2005) measure, we find that the bond-CDS spread frequently understimates the non-default componnent of corporate bond spreads. Our findings imply that non-default factors significantly affect the pricing of not only corporate bonds but also CDS contracts. Our study is also closely related to Chen et al. (2018), who show that liquidity and default risk are inextricably linked in credit-risky bonds. They develop a structural morel to examine the interactions between these components of credit spreads over the business cycle. Our use of guaranteed corporate bonds allows us to provide a model-free estimate of the liquidity component and determine which factors (other than credit risk) affect its magnitude.

A number of previous studies have shown that corporate bond spreads are related to various measures of corporate bond liquidity in either cross-section or time-series data. For example, Chen et al. (2007) find that illiquid bonds earn higher yield spreads, and an improvement in liquidity causes a significant reduction in yield spreads. Covitz and Downing (2007) find that liquidity also plays a role in the determination of very short-term corporate yield spreads. Corporate bond spreads have been shown to be related to various illiquidity proxies, including the outstanding amount (Edwards, Harris, and Piwowar (2007)), time to maturity (Covitz and Downing (2007)), time since issuance (Elton et al. (2001), Feldhütter and Schaefer (2018)), percentage of zero return days (Chen et al. (2007)), institutional ownership (Mahanti, Nashikkar, Subrahmanyam, Chacko, and Mallik (2008)) and different dimensions of illiquidity (Black, Stock, and Yadav (2018)). More recently, Dick-Nielsen et al. (2012) analyze liquidity components of corporate bond spreads during the 2005-2009 period, and find that the contribution from illiquidity increases dramatically with the onset of the subprime crisis. A number of recent papers, including Bao, O'Hara, and Zhou (2018), Bessembinder, Jacobsen, Maxwell, and Venkataraman (2018), and Dick-Nielsen and Rossi (2018), document that dealer intermediation is important for liquidity. We analyze the importance of various liquidity proxies in the sample of guaranteed corporate bonds which allows us to better distinguish between liquidity and credit risk. Our findings imply that the impact of bond characteristics on prices can be overstimated in a sample of risky corporate bonds while the imporance of dealer intermediation can be understimated.

I. Data

A. Bond Data

Our sample is made up of both guaranteed and non-guaranteed bonds issued by companies that participated in the Temporary Liquidity Guarantee Program (TLGP). The program was introduced in October 2008 as part of a coordinated response by the U.S. Governement to the disruption in the financial system and the collapse of credit markets. Under TLGP, financial institutions issued bonds in their own name, even though the bonds were explicitly backed by the full faith and credit of the U.S. Government. The FDIC guaranteed in full, through maturity or December 31, 2012, wichever came first, all newly issued senior unsecured debt that was issued by participants in the program between October 14, 2008 and June 30, 2009. The guarantee covered timely payment of both principal and interest, essentially eliminating the credit risk of the bonds issued under the program.

We identify in the Fixed Income Securities Database (FISD) all public, fixed coupon bonds issued under the TLGP program. After excluding bonds with non-standard features such as conversion rights, call options, and put options, we obtain a sample of 63 bonds issued by 23 companies that were outstanding between December 2008 and December 2012. All the bonds were issued with maturities of 4 years or less and matured before the expiry of the guarantee on December 31, 2012. We then look up all non-guaranteed bonds issued by the same legal entities that were outstanding during the sample period.[4] To correspond to the characteristics of the TLGP bonds, we require that the bonds pay fixed coupon, be senior in the capital structure, and mature in 0.5 to 4 years. Bonds with less than 0.5 years to maturity are not included in the sample. We also exclude bonds that are convertible, callable, or putable. The final sample consists of 63 TLGP and 90 non-TLGP bonds issued by 23 companies.

Our data source for bond transactions and prices is the Trace Reporting and Compliance Engine (TRACE). The TRACE database captures secondary market transactions in both guaranteed and non-guaranteed corporate bonds. Besides transaction prices on all over-the-counter trades (both disseminated and non-disseminated), our version of the TRACE database contains the actual (not estimated) dollar volume of each trade and identities of both the introducing and the executing dealer for each transaction. This allows us to construct better liquidity measures than most prior studies of corporate bond liquidity that rely on publicly disseminated TRACE data. In addition, we are fortunate to have access to detailed information on the dealers from the confidential version of the TRACE datase, allowing us to examine the importance of dealer intermediation for corporate bond liquidity.

We consider all trades reported in TRACE for the sample bonds during the December 2008 to December 2012 period, and filter out erroneous and duplicate entries, trade reversals and cancellations using the procedure described in Goldstein, Hotchkiss, and Sirri (2007).[5] We calcuate the daily closing price for each bond using the last trade on each date of $100,000

[4] We match only bonds issued by the same legal entity. For example, bonds issued by Citibank National Corporation and Citigroup Funding (a special purpose entity) are not matched.

[5] The procedure described in Goldstein et al. (2007) relies on information on dealer identity, non-disseminated trades, and trading volume to identify invalid or duplicate entries. Following this procedure, we eliminate 31 percent of trades because they are duplicate entries, trade reversals, or trades that are inconsistent with reporting guidelines. For a similar procedure that uses only disseminated variables see Dick-Nielsen (2009, 2014).

or larger. The institutional-sized trades (trades of $100,000 or larger) account for more than 98 percent of the trading volume in our sample bonds, although they represent only 27 percent of the total number of 1,782,898 trades. Institutional-sized trades typically have prices that are less volatile that those associated with smaller, retail-sized trades, and are associated with smaller transaction costs (Edwards et al. (2007)). We therefore calculate the daily closing price and measure transaction costs based on institutional-sized trades. However, all the trades, small and large, are used to compute the trading volume and turnover measures.

B. Yield Spreads

We compute the yield spread over the Treasury curve for a bond on a given trading day by discounting each cash flow at the appropriate spot rate plus the spread that matches the daily closing price plus the accrued interest. The spot curve is fitted to off-the-run fixed-coupon Treasury securities with residual maturities of 90 days or more using the Nelson and Siegel (1987) model extended by Svensson (1994). The on-the-run and first off-the-run issues are not used because they frequently trade at a premium to other Treasury securities (Amihud and Mendelson (1991)). Further details of the estimation methodology are provided in Gurnyak, Sack, and Wright (2006). The resulting yield spreads effectively compare the prices of TLGP bonds to comparable Treasury bonds with the same cash flows.

C. Tax Premiums

One difference between corporate and Treasury bonds is that the interest payments on Treasury bonds are exempt from state taxes. This tax exemption lowers the before-tax return that taxable investors require to hold Treasury bonds relative to corporate bonds. As discussed by Elton et al. (2001), estimating the state tax premium in corporate bonds presents a challenge becasue default risk and state tax premiums interact. Fortunately, the effect of state taxes is comparatively easy to isolate in corporate bonds that are free of credit risk. Lewis et al. (2017) show that the portion of the yield spread due to the state income tax effect is $c\tau_s(1-\tau)$, where c is the coupon rate of the bond, τ_s is the marginal state income tax rate, and τ is the marginal federal income tax rate. Following Lewis et al. (2017), we estimate the marginal $\tau_s(1-\tau)$ as the slope coefficient from a simple cross-sectional regression of TLGP bond yield spreads on the coupon rate.[6] The estimated regresson coefficient is 0.01655, and the effect of the state income tax effect on yield spreads is given by the product of 0.01655

[6] We note that only TLGP bond spreads are used to estimate the tax effect. A similar regression using bonds with credit risk would result in biased coefficient estimates.

and the coupon rate. The average effect of taxes on the spreads of TLGP bonds is 3.8 basis points compared to 8.9 basis points for non-guaranteed bonds, reflecting the higher coupon rate of non-guaranteed bonds. We refer to the yield spread after subtracting the effect of state income taxes as the tax-adjusted yield spread.

D. Liquidity Measures

We compute several measures of comporate bond liquidity and transaction costs using detailed, dealer-level data from TRACE. First, we compute the daily effective bid–ask spread of the i^{th} bond as the volume-weighted price difference between all dealer-customer trades in which the j^{th} dealer sells and buys the same bond on a given day t, acting as a principal:

$$BA_{i,t} = \sum_{j} w_{j,t} \left(P^{S}_{i,j,t} - P^{B}_{i,j,t} \right) \tag{1}$$

where $BA_{i,t}$ is the effective bid-ask spread for bond i on date t, $w_{j,t}$ is the j^{th} dealer's share of the trading volume for the i^{th} bond on day t, and $P_{i,j,t}$ is the clean, volume-weighted price for which the j^{th} dealer sells ($P^{S}_{i,j,t}$) or buys ($P^{B}_{i,j,t}$) the i^{th} bond on day t. We use the prices of all principal transactions in which the dealer transacts with a non-dealer client. In a principal transaction the dealer trades with the client against his own inventory. By buying low and selling high, the dealer effectively earns a bid-ask spread, which compensates him for inventory costs, asymmetric information, and any other costs such as clearing and settlement (Glosten and Harris (1988)). In contrast, agency transactions are trades in which the dealer passes a bond on to the customer's account from another dealer without taking on inventory risk. Agency transactions are not included because the dealer's compensation consists of a fixed commission rather than a bid-ask spread. We also exclude interdealer trades because they typically involve much smaller price concessions than dealer-customer trades.

We likewise use TRACE to measure a bond's trading activity in each month. We compute the trading volume and turnover, defined as the annualized ratio of the trading volume relative to the outstanding amount. To capture the price impact of trades, we compute the Amihud (2002) illiquidity measure, defined as the average price change per one million dollars traded. Similar to the effective bid-ask spread, the Amihud measure is based on dealer-customer trades rather than interdealer trades. The measures of liquidity and trading activity are at the monthly frequency.

Two additional liquidity proxies are time to maturity and age, or time since issuance. Time to maturity is an important liquidity measure because short-term securities are de facto liquid by virtue of their short maturity. They can be redeemed at maturity with zero price impact (Covitz and Downing (2007)). Bonds with shorter maturities may also be more liquid due to institutional demand and the existence of investment clienteles (Longstaff et al. (2005)). Chen et al. (2007) also find that a bonds' liquidity tends to decrease with time since issuance as older bonds settle in institutional portfolios with low turnover. We therefore consider bond age as another lliquidity proxy.

We further examine the importance of dealer intermediation and institutional ownership for corporate bond spreads. Duffie et al. (2005) hypothesize that transaction costs are smaller if investors have access to multiple market makers, which increases their bargaining power. To test this hypothesis, we count the number of distinct executing dealers who bought or sold the bond in each month. We consider only dealers who transact with a non-dealer client against their own inventory rather than act as an agent or introducing broker.

In Duffie, Gârleanu, and Pedersen (2007), illiquidity discounts are lower if there is a greater number of institutional investors and counterparties are easier to find. To test this hypothesis, we construct two liquidity measures based on the eMAXX data on institutional bond holdings – the number of reporting institutional investors holding a given bond in each quarter, and the percentage of the bond principal held by institutional investors. The institutions covered by the database include insurance companies, mutual funds, public pension funds, and some other institutions such as endowments and foundations. Although the data on bond holdings does not cover the entire universe of institutional investors (most bank holding company holdings, for example, are not represented), it provides coverage for insurance companies, mutual funds, and public pension funds, allowing us to assess the importance of asset manager holdings for bond liquidity.

E. Summary Statistics

Table I provides summary statistics for the monthly sample of guaranteed (TLGP) and non-guaranteed bonds. The sample is made up of 1,727 month-end observations for TGLP bonds and 2,034 for non-TLGP bonds. The sample period is December 2008 to December 2012. The table shows that guaranteed bonds trade at higher prices (lower yields) than non-guaranteed bonds. The average yield spread is 23 basis points for TLGP bonds, compared to 200 basis points for non-TLGP bonds. The tax-adjusted yield-spread for TLGP bonds is 19 basis points, compared to 191 basis points for non-TLGP bonds. Guaranteed bonds also have a lower coupon rate.

The outstanding amount for TGLP bonds is $2.6 billion compared to $1.3 billion for non-TLGP bonds. The average time to maturity is 1.7 years for both types of bonds, although

TLGP bonds are more recent issues (age 1.26 years) than non-TGLP bonds (age 4.63 years). All of the guaranteed bonds are Aaa rated by at least one major rating agency, while the non-guaranteed bonds have an average rating of A1, with all of the sample bonds rated as investment grade.[7] The issuers' CDS spreads average about 170 basis points for both types of bonds over the sample period, reflecting the fact that the sample is comprised of TLGP and non-TLGP bonds issued by the same companies.

TLGP bonds have larger monthly trading volumes ($266 million vs. $141 million per month) and higher turnover (1.5 vs. 1.1) than non-TLGP bonds, and lower bid-ask spreads ($0.06 vs. $0.39) and the Amihud measure ($0.19 vs. $0.42). However, these bonds also have fewer dealers (25 vs. 45) and and fewer institutional investors (55 vs. 67), although dealers maintain greater inventory holdings for TLGP bonds (13.3% of the oustanding amount) than for non-tlgp bonds (4.4%). Finally, institutional investors other that dealers have smaller holdings of guaranteed bonds (15.5% of the outstanding amount) compared to non-guaranteed bonds (23.6%).

Overall, the summary statistics suggest that guaranteed bonds trade at a premium to non-guaranteed bonds and differ in their characteristics and liquidity. In the next section, we analyze a matched sample of TLGP and non-TLGP bonds to examine the differences in yield spreads between the two types of bonds.

II. Matched Sample Analysis

To measure the magnitude of the bond spread that can be attributed to Government guarantees, we construct a matched sample of guaranteed and non-guaranteed bonds issued by the same corporations and traded on the same days. We also require that the bond pairs have similar maturities (plus/minus 1 year). There are 218 distinct bond paires matched on issuer and time to maturity and a total of 68050 daily pairings. We eliminate sample days with fewer than five observations and thus the figure ends on March 31, 2012.

Figure 1 plots the yield spreads for the TLGP and matched non-TLGP bonds over the period from December 1, 2008 until March 31, 2012. As can be seen, non-TLGP bond spreads are much larger and more volatile than those on matched TLGP bonds, in particular during 2008—2009 period.

Panel A in Table II shows the test for differences in yield spreads and liquidity measures between the bond pairs matched by issuer and time to maturity. The t-statistics are based on standard errors that are clustered along two dimensions – issuer and month (see Thompson

[7] Bond credit ratings are obtained from Moody's and measured on a scale from 1 (Aaa) to 8 (Baa1). If Moody's rating is not available we use instead the equivalent rating from S&P.

(2011)). The average yield spread for TLGP bonds in Panel A is 26 basis points, compared to the average spread of 198 basis points on the matched non-TLGP bonds. The difference between the bond spreads is highly significant. The next row reports the yield yield spreads that are adjusted for the effect of state taxes. The tax-adjusted spread on TLGP bond is 23 basis points, compared to 189 basis points for non-TLGP bonds. After accounting for the effect of taxes, the TLGP bond spread over Treasury bonds can be regarded as a compensation for holding relatively illiquid corporate securities, whereas the difference between the tax-adjusted spreads for non-guaranteed and guaranteed bonds can be interpreted as the implied credit risk. Accordingly, credit risk accounts for 84% of the yield spread (167 bps), while liquidity and taxes account for 12% (23 bps) and 4% (9 bps), respectively.

Figure **??** shows the time-series of the credit risk, liquidity, and tax components in coroporate bond spreads. Clearly, credit risk is the largest and most volatile component of coroporate bond spreads, even for shorter-maturity investment grade bonds on which the sample is based. Credit risk of the TLGP bond issuers peaks during the financial crisis in March 2009 and continues to decrease until August 2011 when it rises again during the European debt crisis. In contrast, the liquidity component reaches its maximum at the beginning of the sample period in December 2008 and exhibits a pronouced declining trend throughout the entire sample period. The tax component remains nearly unchanged over the sample period at around 9 basis points.

Figure 3 plots the liquidity share of the coporate bond spread over the sample period. The liquidity share peaks in December 2008 at around 20% of the bond spread, and declines notably over the first half of 2009. The rapid decline in the liquidity share concides with the introduction of the TLGP program, suggesting that the program helped bring stability to credit markts and improve market liquidity. The liquidity share of coporate bond spreads remains in the 10% to 15% range during the second half of 2009 and in 2010, and it declines to around 5% in the second half of 2011. Notably, the liquidity share does not exceed the credit share at any time during the sample period, which includes the second half of the global financial crisis. These results challenge the so-called credit spread puzzle, namely the finding that credit risk accounts for only a small fraction of yield spreads for investment-grade bonds of shorter maturities (e.g., Elton et al. (2001) and Huang and Huang (2012)).

In addition to yield spreads, Panel A in Table II reports several characteristics of the matched bonds, including time to maturity, the outstanding amount, age, and trading volume. While there is no significant difference in maturities between the matched bond pairs, the other characteristics differ. The TLGP bonds have a significantly larger size, lower age, and greater trading volume than non-TLGP bonds, suggesting that they may be more liquid than the matched non-TLGP bonds. However, sizeable liquidity differences would cloud the interpretation of the yield difference as pure credit risk. To address this concern, we match bonds on additional characteristics in addition to the issuer and maturity.

Panel B in Table II presents a sample of 86 bond pairs (21492 observations) matched by issuer, maturity, and the outstanding amount (plus/minus 100 million dollars). As a result, there is no significant difference between the outstanding amounts of the bonds in this sample. Matching on the outstanding amount also eliminates the difference in trading volume, although TLGP bonds continue to be more recent issues. However, our findings regarding the relative importance of credit risk and liquidity for corporate bond spreads do not change if we match on size. The average tax-adjusted liquidity spread in this sample is about 17 basis points, accounting than 10% of the spread on comparable non-guaranteed bonds (172 basis points).

Finally, Panel C in Table II reports the results of matching on bond age (plus/minus one year) in addition the issuer, maturity, and the outstanding amount. The size of this sample is only 754 observations and 5 distinct bond pairs. Becase TLGP participants were not allowed to issue non-guaranteed bonds along with guaranteed bonds, matching by the age of an issue reduces the sample size significantly. However, the results based on this sample confirm our previous findings regarding the relative importance of credit risk and liquidity for corporate bond spreads. The major part of the corporate bond spread in this sample is due to credit risk (110 basis points), while only 17 basis points, or 13% of the total spread, is attributed to liquidity.

III. Comparison with Bond-CDS Basis

Using the information in credit default swap spreads, Longstaff et al. (2005) measure the non-default components in corporate bond spreads as the bond-CDS basis. In this section, we compare the bond-CDS basis with the illiquidity component based on guaranteed corporate bonds. Although the purpose of both measures is to capture the components in corporate bond spreads that are unrelated to default risk and default risk premia, they are conceptually different. The Longstaff et al. (2005) measure assumes that CDS contracts are perfectly liquid and provide the same exposure to credit risk as corporate bonds. In practice, CDS contracts carry significant liquidity premia and considerations such as funding risk, counterparty risk, and technical reasons such as the cheapest-to-deliver option drive a wedge between CDS payoffs and those of corporate bonds (see Tang and Yan (2007), Bongaerts, De Jong, and Driessen (2011), Arora, Gandhi, and Longstaf (2012), and Bai and Collin-Dufresne (2019)). For example, Bongaerts et al. (2011) find strong evidence for an expected liquidity premium earned by the seller of credit protection, implying that the bond-CDS basis may understimate the non-default component in corporate bond spreads. Similarly, the cheapest-to-deliever option of the CDS protection buyer would tend to reduce the basis and lead to an undestimation of the non-default component. On the other hand, counterparty credit risk of the CDS protection seller, even if its price effect is small (see Arora et al. (2012)), would make the bond-CDS basis overestimate the non-default componet. Therefore, a comparison of the bond-CDS basis with a metric such as the liquidity spread derived from guaranteed corporate bonds might provide useful insights into CDS pricing.

Figure 4 plots the average liquidity component based on guaranteed corporate bonds along with the bond-CDS basis. To compute the basis, we use the maturity-matched sample of non-guaranteed corporate bonds of TLGP bond issuers constructed in Section II. We compare each non-guaranteed bond spread with the spread on the nearest maturity CDS contract written on the same name.[8] Our CDS data is from Markit.

As Figure 4 shows, the bond-CDS basis oscillates around the illquidity spread derived from guaranteed corporate bonds. The correlation between the two measures is 0.80 over the sample period, indicating that both measures are driven by similar non-default components in corporate bond spreads. However, there are also significant differences between the two measures. The bond-CDS basis is much more volatile than the illquidity spread derived from guaranteed corporate bonds, suggesting that factors other than bond market liquidity affect the basis. These factors likely include counterparty credit risk as well as liquidity and supply-demand conditions in the CDS market. Conistent with this conjecture, the bond-CDS basis exceeds the liquidity spread implied by guaranteed corporate bonds in late 2008 and early 2009 when counterparty credit risk concerns affected the CDS market.[9] Conversely, the bond-CDS basis turned shaply negative around the peak of the European debt crisis in October and November 2011 when the balance sheets of European financial instititutions – the typical sellers of CDS protection on U.S. financial institutions – became significantly constrained. The balance sheet constraints of protection sellers made the CDS spreads of U.S. financial institutions exceed the default risk priced in corporate bonds. This episode suggests that supply and demand embalances in the market for credit derivatives affect the cost of CDS protection and the bond-CDS basis. Therefore, the basis cannot be considered as a reliable measure of corporate bond illiquidity.

[8] The analysis is based on CDS contracts with the modified restructing (MR) doc-clause which was most frequently used for investment grade trades in the US during the sample period. As a robustness check, we also consider contracts writtern under the no restucturing clause (XR). The results are similar to those in Figure 4.

[9] The counterparty credit risk concern is more severe for the inssuers in the sample who are mostly financial firms due to the risk of correlated default – so-called wrong-way risk.

IV. Time-series Regressions

In Section II, we estimated the liquidity component in corporate bond spreads as the tax-adjusted TLGP bond spread, and the credit risk component as the difference in tax-adjusted spreads between non-guaranteed and TLGP bonds. To understand what factors affect liquidity and credit risk in corporate bonds, we next examine the time-series behavior of the two compoents.

Table III presents estimates from time-series regressions of the liquidity and credit spread components on measures of market-wide credit risk, liquidity, and volatility. Credit risk is measured by the equal-weighted CDS spreads of the sample firms. Funding liquidity is measured by the spread between the 3-month LIBOR and the 3-month overnight index swap rate (LIBOR-OIS spread), and financial market volatility is measured by the VIX. The regressions are estimated using the daily changes of all variables, and and the specification includes four lags of both the dependent and the explanatory variables to account for autocorrelation in the residuals and possible lead-lag effects. The t-statistics are based on the Newey-West (1980) estimator with four lags.

As shown in Table III, the liquidity component of corporate bond spreads is related to contemporaneous changes in the LIBOR-OIS spread and in VIX. Both the contemporaneous and the lagged coefficients on the issuers' CDS spread are insignificant, confirming that the liquidity component is not driven by the issuers' credit risk. In contrast, the most important determinant of the credit component is issuer credit risk. Both the contemporanous coefficient on the issuer's CDS spread and two lags are highly significant. The LIBOR-OIS spread is only marginally significant at the 10% level in the credit spread regression, and the VIX is insignificant. Overall, the results of the time-series regressions show that the liquidity component in corporate bond spreads largely loads on measures of market liquidity and volatility while the credit risk compoent loads largely on credit spreads – exactly as we would expect from pure measures of either liquidity or credit risk.

V. Cross-section Regressions

We examine next the pricing of corporate bonds in the cross-section, focusing on the liquidity component in corporate bond spreads. A number of previous papers have analyzed the importance for corporate bond spreads of different liquidity proxies, such as the issue size, time to maturity, age, and the bid-ask spread (e.g., Chen et al. (2007); Covitz and Downing (2007); Edwards et al. (2007); Mahanti et al. (2008); Dick-Nielsen et al. (2012)).

However, the effect of illiquidity on corporate bond spreads has proved difficult to establish becasue many of these characteristics covary with the unobserved credit risk of the issuer. As an example, consider the following linear regression:

$$S_i = X_i'\beta + z_i\delta + \varepsilon_i \tag{2}$$

where S_i is spread on the i^{th} bond, X_i is a vector of observable liquidity and credit risk proxies for that bond, z_i is the unobserved credit risk of the i^{th} issuer, and β and δ are column vectors of parameters for liquidity and credit risk. If the unobserved credit risk of the i^{th} issuer (z_i) is omitted from the regression, then the estimate of parameter β will be biased:

$$E\left[\beta|X\right] = \beta + \left(X'X\right)^{-1} X'Z\delta. \tag{3}$$

As shown in Equation (3), the bias $\left(X'X\right)^{-1} X'Z\delta$ is equal to the portion of the unobserved credit risk that is explained by the included liquidity proxies. For example, bid-ask spreads and the price impact tend to be wider for less credit-worthy issuers to the effect of asymmetric information (Glosten and Harris (1988)). The estimated coefficients on these variables will therefore be biased upward, and the regressions will likely overestimate the effect of illiquidity on corporate bond spreads. Other liquidity proxies, including issue size and time to maturity, could also be correlated with issuer credit risk. Less credit worthy issuers find it more difficult to place large bond issues, implying a negative bias for the estimated coefficient on issue size (e.g., Crabbe and Turner (1995)). In addition, Helwege and Turner (1999) document a sample selection bias associated with maturity choice. That is, among firms with the same credit rating, the safer ones tend to issue longer–dated bonds. As a result of this bias, the credit yield curve for speculative-grade issuers appears to be downward sloping even if credit risk increases and liquidity declines as longer maturities.

To obtain unbiased coefficient estimates for a number of liquidity proxies, we restrict the sample to TLGP bonds. These bonds are guaranteed by the full faith and credit of the U.S. The credit risk variable (z_i) in Equation (2) therefore does not enter the true model for these bonds, allowing us to examine the importance of various liquidity factors for corporate bond spreads. Specifically, we estimate cross-section regressions of the tax-adjusted TLGP bond spread S^{TLGP}, measured at the end of month (t), on liquidity characteristics, which are measured during month (t):[10]

[10] We use the tax-adjusted spreads in the regressions to account for the effect of state taxes. The estimates are qualitatively the same if we use the unadjusted spreads except for the coefficient on coupon, which captures the marginal effect of state taxes.

$$S_{i,t}^{TLGP} = X_{i,t}'\beta + \varepsilon_{i,t}. \quad (4)$$

Table IV reports the coefficient estimates, along with the t-statistics adjusted for clustering by issuer and month (Thompson (2011)). As shown in column I, credit risk of the issuer, measured by its CDS spread, is not significantly related to spreads on TLGP bonds, as we would expect for bonds that are free of credit risk. However, columns II–IV show that the spreads are significantly positively related to time to maturity. The coefficient estimate on time to maturity indicates that an increase in maturity by one year increases the liquidity spread by 10 basis points. Prior studies that find maturity to be a significant determinant of bond spreads argue that that maturity could be either a liquidity or a credit risk proxy, but are typically unable to distinguish between the two effects (e.g., Edwards et al. (2007); Covitz and Downing (2007); Dick-Nielsen et al. (2012)). On the one hand, time to maturity is directly related to liquidity becasue hort-term securities can be redeemed at maturity with zero price impact. However, time to maturity is also positively related to credit spreads in structural models of credit risk with Merton-type dynamics. As shown in Merton (1974), high-grade issuers face upward sloping yield curves becasue their probability of default increases with time to maturity. Our finding that maturity is significantly positively related to bond spreads in a sample of bonds that are free of default risk supports the interpretation of maturity as a liquidity measure, although, as we shall see below, its effect can be overestimated by failing to consider that the maturity choice depends on credit risk.

Specification III includes additional liquidity metrics such as the bid-ask spread, the Amihud measure, and the log of the trading volume and the outstanding amount. The coefficient on the bid-ask spread is significant at the 10% level, indicating that a 10 basis point increase in the bid-ask spread leads to a 1.5 basis point increase the the yield spread for TLGP bonds. The marginal effect of the log outstanding amount is -1.52, showing that a 10% increase in the outstanding amount will lower bond spreads by about 0.15 basis points. Other bond characteristics, such as the age, trading volume, and the Amihud measure, are not significantly related to the liquidity spread.

Finally, specification IV includes variables related to the investor base and dealer intermediation. The coefficient on the number of dealers is negative and highly significant, showing that bonds marketed by a greater number of dealers trade at lower spreads. The size of the effect is meaningful, with an additional dealer lowering spreads by 0.12 basis points. The coefficient on dealer inventory positions is also significantly negative, indicating that a 10% increase in inventory reduces TLGP bond spreads by 1.7 basis points. These findings provide support for models of search and bargaining in over-the-counter markets (e.g., Duffie et al. (2005)), in which bond spreads are lower if investors have access to a greater number of market makers. However, the number of institutional investors and their holdings are not significantly related to TLGP bond spreads.

Overall, the regressions of TLGP bond spreads on bond characteristics show that the liquidity component of corporate bond spreads is significantly related to a number of liquidity proxies in the cross-section of bonds. The signs and magnitude of the estimated coefficients are consistent with the theory that liquidity is one of the factors affecting corporate bond spreads.

Table V reports the estimates of model 4 for the sample of non-guaranteed bonds. Unsurprisingly, the issuers' CDS spread is the most important factor affecting the yield spreads of these bonds. However, even after controlling for credit spreads, the coefficients on several of the liquidity measures appear biased, as one would expect in the presence of unobserved credit risk (see Equation (3)). For example, the effect of the bid-ask spread is overestimated by a factor of seven compared to the regression using the guaranteed bond sample. This finding suggests that the bid-ask spread is, to a large degree, a compensation for credit risk rather than liquidity. An issuer's credit risk is subject to asymmetric information, which contributes to wider bid-ask spreads (Glosten and Harris (1988)). The coefficients on time to maturity, coupon, and the Amihud measure are also overestimated, suggesting that these characteristics are correlated with the issuer's credit risk. In contrast, the variables related to dealer intermediation are insignificant in the regressions using non-TLGP bonds, suggesting that their coefficients are biased toward zero. Dealers may, for example, prefer to share risk on riskier bonds more widely and trade more frequently in the interdealer network (Reiss and Werner (1998)), which may positively bias the (otherwise negative) coefficient on the number of dealers. Also, risk averse dealers seek to reduce excess inventory holdings of risky bonds by selling them in the market (Ho and Stoll (1981)), even at dipressed prices. Large dealer holdings may therefore be associated with distressed sales, biasing the coefficient estimate on dealer inventory toward zero. Overall, the estimates in Table V demonstrate the potential biases associated with analyses of liquidity effects among bonds that are subject to credit risk.

VI. Conclusion

The effects of liquidity and credit risk on corporate bond spreads are interrelated, making it difficult to determine how much liquidity contributes to corporate bond spreads. We overcome this problem by studying a unique sample of corporate bond that are free from credit risk becasue they are guaranteed by the full faith and credit of the U.S. Our evidence indicates that credit risk is the most important determinant of the prices of investment grade corporate bonds with short- and medium-term maturities. However, the effect of liquidity is frequently larger than suggested by estimates based on the bond-CDS basis. Liquidity accounts for 12% of investment grade bond spreads on average and 20% during liquidity crises.

Our paper contributes to the literature on corporate bonds by providing unbiased estimates of the liquidity component in corporate bond spreads. In the time-series, we find that the liquidity commponent of corporate bond spread is driven by contemporaneous changes in the LIBOR-OIS spread, a funding liquidity measure, and comoves with market volatility. Our results in the cross-section highlilght the importance of dealer intermediation for corporate bond liquidity. We also show that that the importance of liquidity measures such as bid-ask spreads and the Amihud measure for illiquidity discounts tends to be overestimated in prior studies because these metrics are positively related to credit risk in the sample of non-guaranteed corporate bonds. On the other hand, the importance of factors such as the number of dealers and dealer inventory tends to be underestimated.

Overall, this paper contributes to the literature on liquidity in over-the-counter market in general, and in the corporate bond market in particular. Future research should use similar methods to examine the role of non-default factors in other markets such as the market for financial derivatives.

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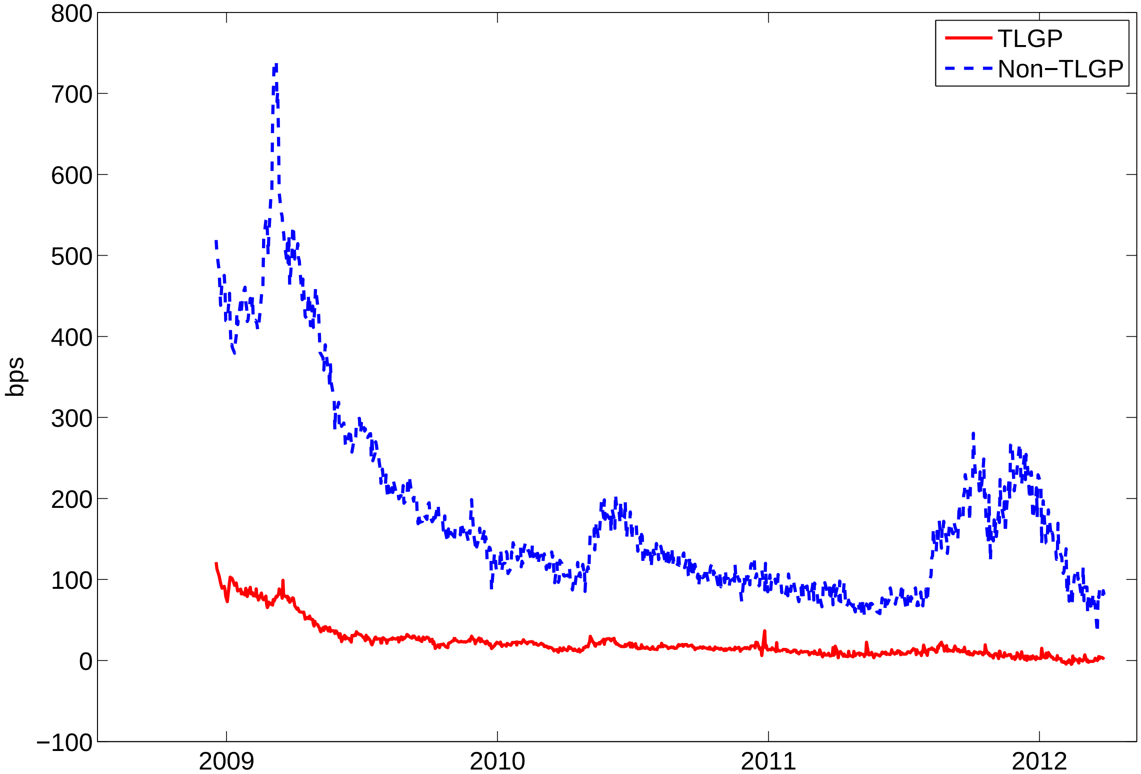
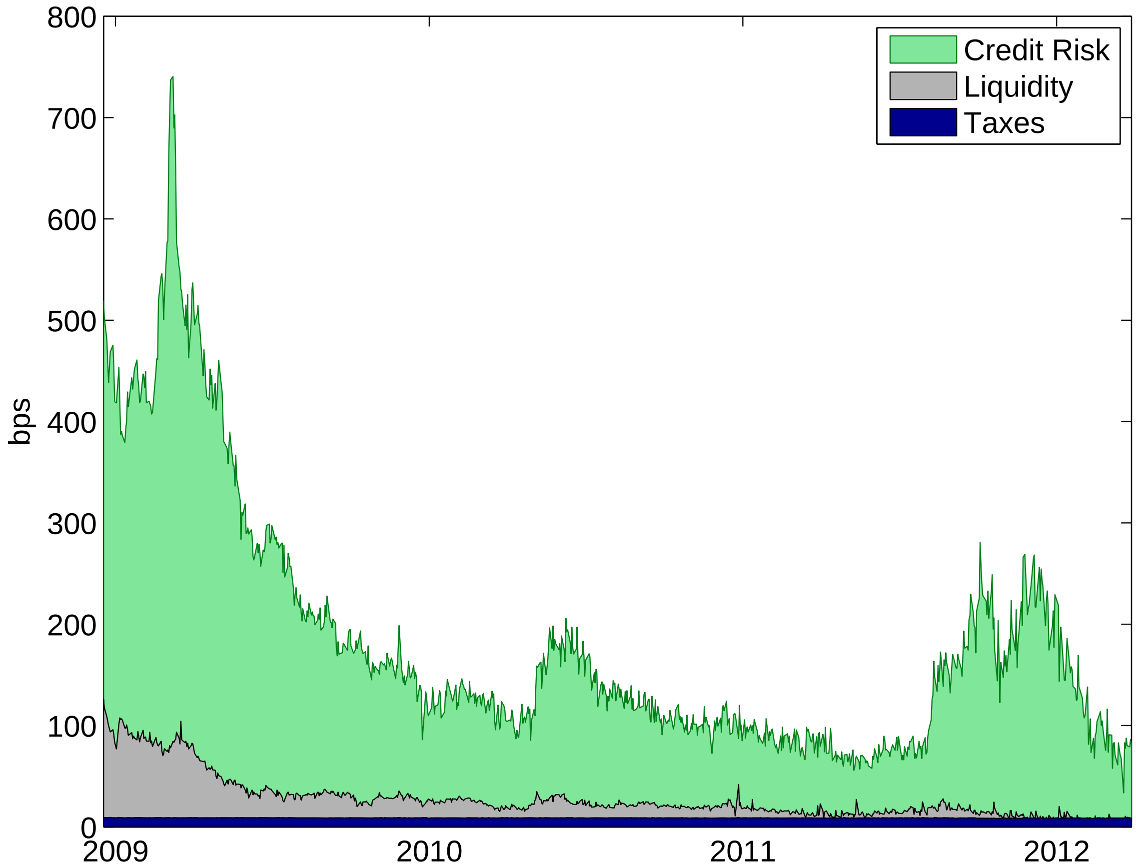
Figure 1. Average spreads for guaranteed and matched non-guaranteed bonds



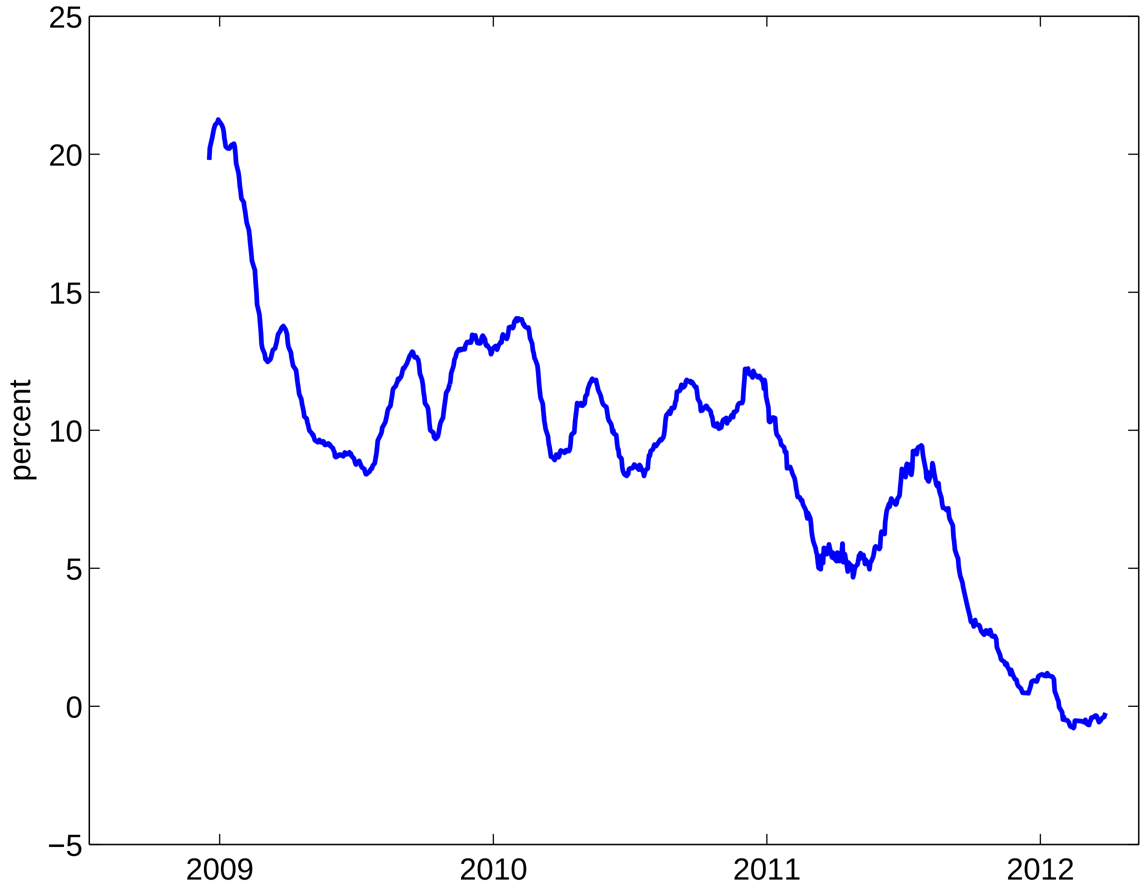
Note: This figure shows the average daily spread for guaranteed (TLGP) and matching non-guaranteed (non-TLGP) bonds, and the difference over the period from December 2008 until March 2012. The bonds are matched by issuer and time to maturity, and spreads are averaged across all bonds that trade on the same day.

Figure 2. Decomposition of corporate bond spreads into credit risk, liquidity, and tax components



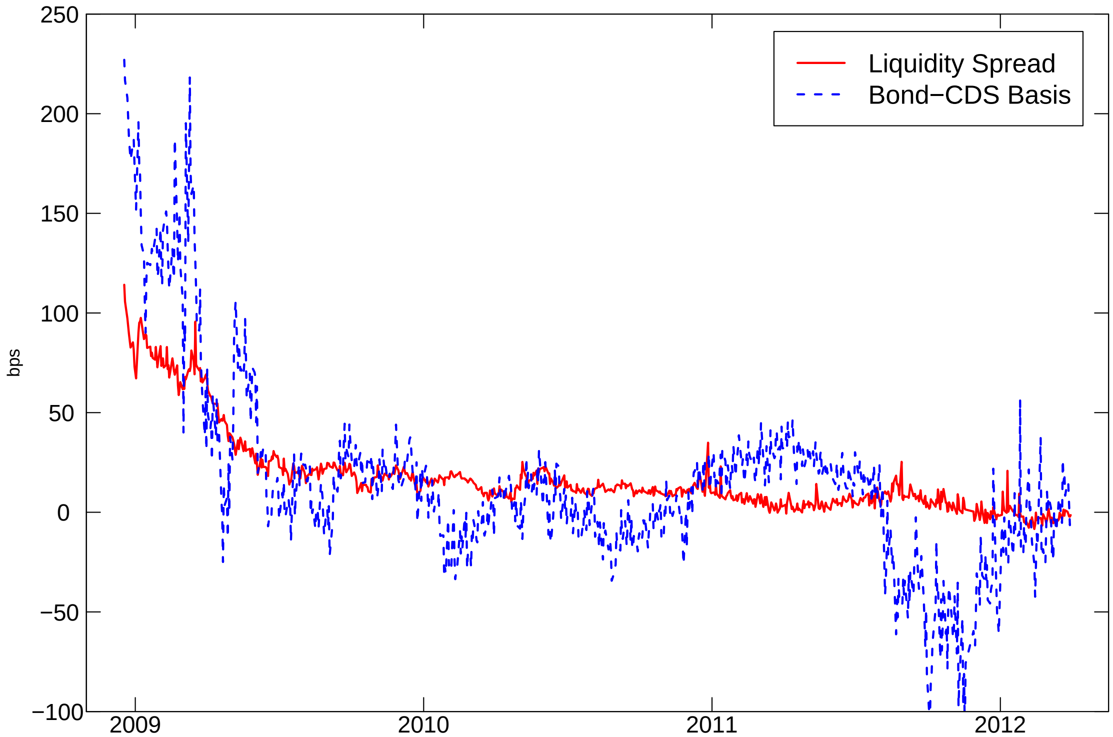
Note: This figure shows the spread on corporate bonds from December 2008 until March 2012, decomposed into credit risk, liquidity, and tax components. Guaranteed and non-guaranteed bonds are matched by issuer and time to maturity. The liquidity component is measured as the guaranteed bond spread, adjusted for the effect of taxes. The credit risk component is the difference between the matched bond spreads, adjusted for the effect of taxes.

Figure 3. Liquidity share of corporate bond spreads



Note: This figure shows the liquidity share of corporate bond spreads over the period from December 2008 until March 2012. Guaranteed and non-guaranteed bonds are matched by issuer and time to maturity. The liquidity component is measured as the guaranteed bond spread, adjusted for the effect of taxes.

Figure 4. Liquidity spread and bond-CDS basis



Note: This figure plots the liquidity spread derived from guaranteed corporate bonds along with the maturity-matched bond-CDS basis from December 2008 until March 2012. The bond-CDS basis is computed by contrasting the the yield spread of non-guaranteed bonds with the spread on the nearest maturity CDS contract written on the same name.

Table I
Summary Statistics

	TLGP			Non-TLGP		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Yield (%)	0.91	0.73	0.58	2.66	2.06	2.08
Yield spread (bps)	23.05	18.06	21.08	200.13	134.70	187.28
Tax-adjusted yield spread (bps)	19.22	14.05	20.94	191.20	125.70	187.08
Coupon (%)	2.32	2.15	0.55	5.40	5.35	0.85
Amount outstanding ($MM)	2625.32	2250.00	1779.26	1328.20	1000.00	995.00
Time to maturity (years)	1.75	1.68	0.78	1.71	1.57	0.84
Age (years)	1.26	1.20	0.78	4.63	3.95	2.50
Rating	AAA	AAA	0.00	A+	A	1.96
Issuer CDS spread (bps)	167.45	146.94	94.49	174.11	161.82	123.96
Trading volume ($MM)	325.71	181.52	408.63	141.07	70.04	1120.91
Turnover	1.52	1.01	1.60	1.10	0.75	4.54
Amihud measure	0.19	0.07	0.42	0.42	0.30	0.43
Bid-ask spread	0.06	0.05	0.09	0.39	0.28	0.41
Number of dealers	24.97	23.00	12.60	45.13	43.00	25.38
Number of institutional investors	54.79	53.00	29.94	66.90	58.00	37.16
Dealer inventory (%)	13.29	12.59	8.13	4.39	3.54	3.79
Institutional holdings (%)	15.45	13.52	8.40	23.55	18.19	16.61
Number of observations	1727			2034		
Number of bonds	63			90		

This table provides summary statistcs for the sample of TLGP (guaranteed) and non-TLGP (non-guaranteed) bonds during the period from Deceber 2008 to December 2012. The sample bonds were issued by companies participating in the TLGP program, are senior in the capital stracture, mature in 0.5 to 4 years, and have no option or conversion features.

Table II
Differences between matched pairs of TLGP and non-TLGP bonds

Panel A: Matched by issuer and time to maturity

Variable	TGLP	Non-TLGP	Difference	t-statistic
Yield spread	26.81	198.45	-171.65	-6.15^{***}
Tax-adjusted yield spread	22.91	189.49	-166.58	-6.00^{***}
Time to maturity	1.89	1.89	0.00	0.05
Amount outstanding	3650.68	1729.53	1921.14	9.67^{***}
Age	1.12	4.68	-3.56	-16.84^{***}
Trading volume	509.28	153.57	355.71	5.95^{***}
Number of bond pairs	218	218		
Number of observations	68050	68050		

Panel B: Matched by issuer, maturity, and amount outstanding

Variable	TGLP	Non-TLGP	Difference	t-statistic
Yield spread	20.55	171.78	-151.23	-6.14^{***}
Tax-adjusted yield spread	16.92	162.48	-145.57	-5.92^{***}
Time to maturity	1.81	1.88	-0.08	-1.34
Amount outstanding	2419.07	2393.88	25.19	0.28
Age	1.22	5.16	-3.94	-12.24^{***}
Trading volume	236.54	211.31	25.23	1.51
Number of bond pairs	86	86		
Number of observations	21492	21492		

Panel C: Matched by issuer, maturity, amount outstanding, and age

Variable	TGLP	Non-TLGP	Difference	t-statistic
Yield spread	21.84	135.50	-113.66	-8.26^{***}
Tax-adjusted yield spread	17.39	127.79	-110.40	-8.31^{***}
Time to maturity	1.71	2.41	-0.71	-1.56
Amount outstanding	2265.05	2271.02	-5.97	-0.21
Age	1.34	1.95	-0.61	-1.08
Trading volume	167.86	199.81	-31.95	-0.61
Number of bond pairs	5	5		
Number of observations	754	754		

This table shows the yield spreads and liquidity metrics for TLGP and non-TLGP bond pairs that trade on the same days. In Panel A, bonds are matched on issuer and time to maturity (plus/minus one year). In panel B, bonds are matched on issuer, time to maturity (plus/minus one year), and the outstanding amount (plus/minus 100 million dollars). In panel C, bonds are matched on issuer, time to maturity (plus/minus one year), the outstanding amount (plus/minus 100 million dollars), and age (time since issuance plus/minus one year). The t-statistics are based on standard errors that are clustered by issuer and month. Superscripts ***, **, * indicate significance at the one, five, and ten percent level, respectively.

Table III
Time-series regressions for liquidity and credit spreds

		Liquidity spread		Credit spread	
Variable	Lag	Coefficient	*t*-statistics	Coefficient	*t*-statistics
Intercept		-0.140	−1.32	−0.447	−0.79
Bond spread	1	-0.443	−7.23***	−0.393	−6.32***
Bond spread	2	-0.271	−5.13***	−0.165	−2.05**
Bond spread	3	-0.061	−1.27	−0.029	−0.39
Bond spread	4	0.057	1.51	−0.043	−0.77
Issuer CDS spread	0	0.011	0.44	0.588	4.70***
Issuer CDS spread	1	0.006	0.27	0.537	4.36***
Issuer CDS spread	2	-0.016	−0.66	0.383	2.93***
Issuer CDS spread	3	0.009	0.37	0.040	0.18
Issuer CDS spread	4	0.013	0.62	−0.141	−0.83
LIBOR-OIS spread	0	0.465	3.77***	1.138	1.83*
LIBOR-OIS spread	1	0.064	0.37	0.296	0.58
LIBOR-OIS spread	2	-0.026	−0.17	−0.168	−0.28
LIBOR-OIS spread	3	-0.066	−0.37	−0.649	−0.93
LIBOR-OIS spread	4	0.191	1.32	0.199	0.32
Volatility (VIX)	0	0.249	4.2***	0.311	0.92
Volatility (VIX)	1	0.083	1.21	0.049	0.16
Volatility (VIX)	2	0.089	1.5	−0.538	−1.49
Volatility (VIX)	3	-0.037	−0.54	0.547	1.19
Volatility (VIX)	4	-0.063	−0.88	0.486	1.09
Adj. R^2		0.229		0.208	
Number of observations		819		819	

This table reports the results of time-series regressions of daily changes in liquidity and credit spreads on changes in explanatory variables. The sample period is from December 2008 to March 2012. The t-statistics are based on the Newey-West (1980) estimator with four lags. The superscripts ***, **, * indicate significance at the one, five, and ten percent level, respectively.

Table IV
Regressions of TLGP bond spreads on bond characteristics

	I.	II.	III.	IV.
Issuer CDS spread	0.83	0.82	1.03	0.80
	(1.18)	(1.24)	(1.62)	(1.56)
Time to maturity		9.99***	10.03***	9.60***
		(9.44)	(9.22)	(9.10)
Age		−1.15	−0.48	−0.91
		(−0.63)	(−0.31)	(−0.56)
Coupon		0.00	0.00	0.01
		(0.53)	(0.36)	(0.93)
Bid-ask spread			15.43*	15.65**
			(1.72)	(2.05)
Amihud measure			−1.19	−0.43
			(−1.49)	(−0.53)
Log of trading volume			0.08	0.85***
			(0.24)	(2.65)
Log of outstanding amount			−1.52***	−1.58***
			(−2.70)	(−2.79)
Number of investors				−0.58
				(−0.75)
Institutional holdings				−0.03
				(−0.80)
Number of dealers				−0.12***
				(−2.95)
Dealer inventory				−16.67***
				(−5.81)
Adj. R^2	0.08	0.63	0.69	0.71
Number of observations	1727	1727	1727	1727

This table reports the results of cross-sectional regressions of TLGP bond spreads, adjusted for the effect of taxes, on bond- and issuer-specific characteristics. Issuer CDS spread is expressed as a precentage. The sample period is monthly from December 2008 to December 2012. The regressions are estimated with time fixed effects. Stanadard errors clustered at the issuer and time level, and t-statistics are reported in parentheses below the coefficient estimates. Superscripts ***, **, * indicate significance at the one, five, and ten percent level, respectively.

Table V
Regressions of non-TLGP bond spreads on bond characteristics

	I.	II.	III.	IV.
Issuer CDS spread	57.38***	54.39***	39.18***	40.86***
	(2.65)	(2.83)	(2.85)	(3.91)
Time to maturity		40.52***	19.02***	15.21***
		(3.80)	(3.04)	(2.42)
Age		−0.45	−2.72	−4.30
		(−0.07)	(−0.79)	(−1.13)
Coupon		0.28*	0.26**	0.25**
		(1.90)	(2.17)	(2.48)
Bid-ask spread			109.13***	112.10***
			(4.15)	(4.22)
Amihud measure			10.20**	10.10**
			(1.96)	(1.95)
Log of trading volume			6.29	5.12
			(0.98)	(0.70)
Log of outstanding amount			−7.82	−21.08
			(−0.59)	(−0.69)
Number of investors				0.42
				(0.71)
Institutional holdings				−0.13
				(−0.19)
Number of dealers				0.02
				(0.05)
Dealer inventory				24.86
				(0.16)
Adj. R^2	0.38	0.49	0.66	0.66
Number of observations	2034	2034	2034	2034

This table reports the results of cross-sectional regressions of non-TLGP bond spreads, adjusted for the effect of taxes, on bond- and issuer-specific characteristics. Issuer CDS spread is expressed as a precentage. The sample period is monthly from December 2008 to December 2012. The regressions are estimated with time fixed effects. Stanadard errors clustered at the issuer and time level, and t-statistics are reported in parentheses below the coefficient estimates. The superscripts ***, **, * indicate significance at the one, five, and ten percent level, respectively.