Journal of Financial Stability 25 (2016) 58–69

Contents lists available at ScienceDirect

Journal of Financial Stability

journal homepage: www.elsevier.com/locate/jfstabil

How much can illiquidity affect corporate debt yield spread?☆

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ARTICLE INFO

Article history:
Received 13 January 2016
Received in revised form 21 April 2016
Accepted 29 June 2016
Available online 8 July 2016

JEL classification:
G01
G12
G13

Keywords:
Corporate bonds
Illiquidity
Illiquidity spread
Yield spread
Financial crisis

ABSTRACT

We present a structural method for measuring the upper bound for the illiquidity risk of liabilities issued by a levered firm. The method calculates the upper bound of illiquidity spread of a corporate bond given its duration and the issuing firm's asset risk and leverage ratio. Consistent with the empirical literature the illiquidity spread is positively related to the issuing firm's asset risk and leverage ratio and the illiquidity component increases with a bond's credit quality. The term structure of illiquidity spread has a humped shape, where its maximum level depends on the firm's leverage ratio. Finally, we demonstrate how the method's implied restricted trading period can be used as a measure for illiquidity in the bonds' market.

1. Introduction

The effect of illiquidity on the valuation of corporate bonds has been extensively studied (Bao et al., 2011; Chen et al., 2007; Huang and Huang, 2012; Helwege et al., 2014; Longstaff et al., 2005). In particular, financial research has focused on the relative effects of illiquidity and credit risk in determining a corporate bond yield spread, and how illiquidity varies with a bond's credit quality and a debt's duration.[1] The 2007–2009 crisis, when market liquidity dried up (White, 2008; Cukierman, 2011, 2013), highlights the importance of understanding this relationship, since both illiquidity and credit risk intensified at the same time, and the relative contribution of each component was not clear (Bao et al., 2011; Friewald et al., 2012; Goodhart, 2008; Pelizzon et al., 2015; Schwarz, 2014). The Basel Committee on Banking Supervision (2013) recently recognized that liquidity and solvency risks are often interlinked, but are frequently treated separately in (supervisory) stress tests, whereby this separate treatment of capital and liquidity understates bank risk.

In this paper we present a simple theoretical method that calculates an upper bound for the illiquidity discount of corporate liabilities. In the financial literature there are several models for finding the upper bound for the illiquidity discount of securities issued by an unlevered firm (Longstaff, 1995; Finnerty, 2012). However, none of these models suggests a general solution that accounts for the case of corporate liabilities issued by a levered firm. The suggested generalization is implemented by integrating structural models for pricing corporate liabilities (Longstaff and Schwartz, 1995; Merton, 1974) with a model that measures illiquidity discount. While previous works only consider a firm's asset risk and the length of the restricted trading period as the determining factors of illiquidity discount, the generalized approach, suggested in this paper, also considers the firm's capital structure and the duration of its debt. Further, by using a conventional analogy between structural models and reduced-form models, the illiquidity discount can be analyzed using a bond's recovery rate and probability of default.

The upper bound for the illiquidity discount is calculated in two stages. In the first stage, the value of the corporate bond is unbundled into a long position in a risk-free asset and a short position in the potential loss of the bondholder in the event of default by using

☆ We thank the Editor, Iftekhar Hasan, and two anonymous referees for helpful and constructive comments. We also thank Simon Benninga, Jens Hilscher, Jingzhi Huang, Dan Galai, Olaf Korn, Zvi Wiener, the seminar participants at Brandeis University, the participants of the annual meeting of the Israeli Economic Association and the XXIV international Rome conference on Money, Banking and Finance.

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[1] A corporate bond's yield spread is the difference between the bond's yield to maturity and a given default-free interest rate of the same maturity.

http://dx.doi.org/10.1016/j.jfs.2016.06.011
1572-3089/

a structural model. In the second stage, we value the corporate liability under the assumption of no trading restrictions and calculate the illiquidity discount as the difference between this value and the bond's price in the existence of such restrictions.[2] The value of the liability with no trading restrictions is calculated by assuming, as in Longstaff (1995), a hypothetical investor with perfect market-timing ability. In the absence of trading restrictions, this investor would sell at the maximum price that the security reaches during this period. The value under the trading restriction is the value of the corporate liability at the end of the trading restriction period under the structural model, which accounts for credit risk only. Thus, in this method, we can unbundle credit risk from liquidity risk.[3]

The method provides a number of important new insights into the potential effects of illiquidity on the pricing of corporate bonds. First, for a given restricted trading period and a firm's asset risk, we find that the illiquidity discount of a corporate bond is smaller than of a stock for an identical unlevered firm.[4] This result implies that using models such as Longstaff (1995) and Finnerty (2012) that ignore leverage and duration and consequently treat a bond's illiquidity in the same way as stocks would overprice the illiquidity discount of a corporate debt.

Second, while the relationship between asset risk and illiquidity discount has been explored in the theoretical literature (Longstaff, 1995), our paper is the first to establish a link between leverage and illiquidity. We find that illiquidity spread (the part of a corporate bond's yield spread that is due to liquidity risk) increases with a firm's leverage and asset risk. Our findings are consistent with the empirical literature showing that illiquidity spread decreases with a bond's credit quality (Bao et al., 2011; Chen et al., 2007; Dick-Nielsen et al., 2012; Friewald et al., 2012; Huang and Huang, 2012; Longstaff et al., 2005). We show that a firm's leverage has a major effect on the size of the illiquidity spread of a corporate bond. For example, the upper bound for the illiquidity spread of a zero-coupon corporate bond with 4 years to maturity of a firm with an asset risk of 30% and a leverage ratio of 30% equals 3 (6) basis points when the length of the restricted trading period equals 10 (30) days. Ceteris paribus, a corporate bond of a firm with a leverage ratio of 70% has an illiquidity spread of 29 (50) basis points for a restricted trading period of 10 (30) days.

Further, the method yields an illiquidity component (i.e., the illiquidity spread out of a bond's total yield spread) that increases with a corporate bond's credit quality. Again, this result is consistent with the empirical literature that shows that the portion of yield spread explained by credit risk increases as a bond's credit quality decreases (Friewald et al., 2012; Longstaff et al., 2005; Huang and Huang, 2012).

Third, the model's term structure of illiquidity spread, which describes the relation between illiquidity spread and a bond's duration, has a humped shape. This term structure is consistent with the shape predicted by Koziol and Sauerbier (2007). However, our model provides a new testable hypothesis by showing that the duration at which the curve reaches its maximum depends on a firm's leverage ratio. As leverage increases, the curve reaches its maximum at a shorter duration, where the curve becomes downward-sloping. The results are also consistent with the empirical downward-sloping shape of the term structure found by Ericsson and Renault (2006), since bonds with less than one year to maturity are excluded. In addition, we find that the term structure of illiquidity spread reaches its maximum at the same duration, irrespective of the choice of the restricted trading period (duration of one year). This means that in periods of financial distress as well as in periods of financial stability the illiquidity spread reaches its peak in bonds with the same duration.

The implications of our method for corporate bond pricing are derived from the interpretation that is given to the restricted trading period. If we simply understand it as the period of time in which an investor is forbidden from trading a security, the method can be used to estimate the required illiquidity spread of private placement under the SEC Rule 144A, which allows the trading of privately placed securities among qualified institutional buyers. These debt instruments are traded at a discount with respect to publicly offered debt (Chaplinsky and Ramchand, 2004; Livingston and Zhou, 2002). Moreover, the method can be used for the valuation of syndicated loans, where the syndication process is timely and usually an immediate transaction is almost impossible.

A broader interpretation of the restricted trading period is an expected future period of market dry-out in which trading in a security is limited. The model's implied restricted trading period can be extracted given the illiquidity spread of a bond and be used by investors, risk managers, and regulators as a novel measure of the expected period of market dry-out. Applying this approach, we refer to Dick-Nielsen et al. (2012) who estimate that during the subprime crisis the illiquidity component accounted for approximately 29% of the yield spread of corporate bonds that mature in 3–5 years (relative to 13% in the post-crisis period).[5] We show that for corporate bonds with features that are typical to a rating category of A and BB, an illiquidity component of 29% implies minimum restricted trading periods of 82 and 160 days, respectively. This is consistent with the observed period of market dry-out in the financial markets, which implies a restricted trading period between 3 and 5 months.

Finally, our work contributes to the understanding of the "credit spread puzzle," that is, the claim that yield spreads of corporate bonds are larger than what can be explained by the default risk implied by structural models (Collin-Dufresne et al., 2001; Elton et al., 2001; Huang and Huang, 2012). According to Longstaff et al. (2005), the non-default yield spread is strongly related to measures of corporate bond illiquidity and does not relate to the differential state tax treatment given to Treasury and corporate bonds. Our work can be used as a yardstick for testing equilibrium models for the valuation of both the predicted credit spread and illiquidity spread. To this end we show how our method can be expressed in terms of reduced-form models that are based on a firm's default probability and a bond's recovery rate.

The rest of the paper is organized as follows. Section 2 describes the related literature. Section 3 presents the framework of analysis for calculating the upper bound for illiquidity of corporate liabilities, namely, stocks and bonds. Section 4 discusses the implications for the analysis of corporate liabilities. Section 5 concludes the paper.

2. Related literature

The effect of a restricted trading period on the pricing of securities is modeled first on Mayers (1973, 1976), Brito (1977), Stapleton and Subrahmanyam (1979), and Boudouch and Whitelaw (1993) by

[2] Restricted trading is an extreme case of illiquidity and therefore serves as an upper bound for illiquidity.

[3] Finnerty (2012) suggests an alternative trading rule for calculating an illiquidity premium by assuming that investors cannot perfectly time the market and instead compare between the average price of the asset during the restricted trading period and its value at the end of the period.

[4] Usually, the observed restricted trading period of stocks is much shorter than the observed restricted period of corporate bonds, as they are traded in a centralized clearing.

[5] The view that illiquidity discount increases sharply when the general state of the economy is bad is supported also by Schuster and Uhrig-Homburg (2015) and Schwarz (2014).