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ORIGINAL RESEARCH

Managerial ability, information quality, and the design and pricing of corporate debt

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Abstract We examine if managerial ability affects the efficiency of the contracting environment with lenders. We find that higher ability alters the balance of information-sensitive covenants demanded by outside investors, increases the issuance of bonds with longer maturity, and decreases the issuance of senior secured debt. We also document higher ability reduces the risk premium demanded by investors on information-sensitive debt. These results are collectively consistent with the premise that the mitigation of information risk is an important dimension of managerial ability that has a direct bearing on the structure and pricing of corporate debt.

Keywords Managerial ability · Asymmetric information · Corporate debt

JEL Classification G12 · G32 · G34

1 Introduction

The value relevance of managerial characteristics has been the subject of considerable debate. Stemming from the notion that more capable managers have a better understanding of technology, industry trends, and customer demand, a growing literature studies the impact of managerial ability on corporate policies including investment, financing, and other operating activities that have a direct bearing on firm value. A segment of this literature focuses on the association between managerial ability and the quality of the information environment surrounding the firm (e.g. Demerjian et al. 2013; Demerjian et al. 2015).

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For example, Demerjian et al. (2013) argue that better management teams are more knowledgeable about future economic conditions resulting in lower earnings noise, while Baik et al. (2011) find that a CEO's ability is positively linked to improved accuracy of earnings forecasts.

Prior research indicates that investors assess less risk and expect lower compensation from securities of companies that provide more and higher quality information. For example, Amihud and Mendelson (1989) and Diamond and Verrecchia (1991) show that investors' perception of risk is a decreasing function of available information and that better disclosure increases future liquidity. Similarly, Zhang (2006) and Lu et al. (2010) show that information uncertainty leads to higher expected stock returns and higher corporate bond yield spreads, respectively. Further, prior work demonstrates that managerial skill and ability contribute to information quality and risk: for example, Demerjian et al. (2013) argue that better management teams are more knowledgeable about future economic conditions resulting in lower earnings noise, while Baik et al. (2011) find that a CEO's ability is positively linked to improved accuracy of earnings forecasts.

We surmise that a channel by which ability affects value is through its effect on the contracting environment with outside lenders. Prior work supports the view that bond issuers use characteristics such as covenant structure, maturity, seniority, and embedded options to mitigate the adverse effects of information asymmetry. To the extent that these choices are products of the firm's internal and external operating environment, we expect that the relation between managerial ability and information risk will affect non-price characteristics of corporate debt that are linked to information quality and timeliness. In addition, we expect managerial ability to affect the secondary market pricing of information-sensitive debt. Our information-based hypotheses further suggest a pronounced impact of ability on the pricing of ability into debt contracts when information sensitivity is high, i.e. in situations when the buyer has an incentive to acquire information about the bond's underlying collateral before purchasing (Holmström 2015). Using default risk and liquidity to gauge information sensitivity, we find evidence supporting these premises: the impact of managerial ability on yield spreads significantly increases in default risk and is robust to a variety of default risk measures. In a similar vein, we show that the impact of managerial ability on yield spread is increasing with the degree of illiquidity of the issuing firms' securities, and this result is robust to a variety of liquidity measures. Viewed collectively, our results demonstrate that the impact of managerial ability on information risk plays an important role in the structure of new securities and in the subsequent pricing of these securities in the secondary markets.

We organize the remainder of the paper as follows. In Sect. 2, we survey related work and introduce our formal hypotheses. In Sect. 3, we describe our sample and define variables. In Sect. 4, we describe the empirical approach and present our main empirical results. Section 5 concludes.

2 Literature review and hypotheses

A developing literature supports the view that high-ability managers are more valued by the executive labor market and play a significant role in corporate policies that more efficiently manage resources and maximize firm performance. For example, Chang et al. (2010) associate CEO ability with executive pay and firm performance by demonstrating that the market reaction to news of CEO departures is negatively correlated with the firm's prior performance and the CEO's prior pay. Further, prior performance and CEO pay are associated with the CEO's subsequent success in the managerial labor market, supporting the view that there is variation in cross-sectional CEO ability that affects firm value and performance. Additional evidence on the link between CEO ability and performance is provided by Andreou et al. (2013), who investigate the relation between ability and performance in the context of the 2008 financial crisis. They find that higher ability managers are better able to preserve resources during crises, either by generating more cash flow from existing assets or by alleviating funding constraints by issuing more debt, which subsequently improves firm performance by reducing underinvestment problems. In recent work, Bonsall et al. (2016) show that credit rating agencies incorporate managerial ability into bond credit ratings, concluding that ability is a default risk factor in the pricing of at-issue bond yield spreads. Further, Koester et al. (2016) demonstrate that management team ability affects tax policy decisions that result in greater tax avoidance.

Recent work also links higher managerial ability with better earnings quality and lower accounting information risk. This literature begins with Baik et al. (2011), who show that CEO ability is directly associated with the likelihood, frequency, and informativeness of management earnings forecasts. They argue that these findings collectively support Trueman's (1986) premise that higher ability CEOs have a greater awareness of the underlying fundamentals of their firm and, therefore, are more likely to better anticipate their firm's prospects. In a similar vein, Demerjian et al. (2013) establish an empirical association between managerial ability and earnings quality. Based on the premise that superior managers are more knowledgeable about their business environment, Demerjian et al. (2013) surmise that a more capable management team is able to estimate accruals more accurately. They provide evidence in support of this contention, showing that higher managerial ability scores are associated with higher earnings quality as measured by earnings restatements, earnings persistence, the accuracy of the bad debt provision, and the mapping of working capital accruals into cash from operations. In further work, Demerjian et al. (2015) examine the link between managerial ability and earnings smoothing and find that superior managers are more likely to provide a smoother earnings stream that is more associated with future earnings; smoother earnings benefits shareholders as smoothing reduces the likelihood of breaking debt covenants and meeting earnings expectations. Similarly, Crabtree and Maher (2005) document that bonds of firms with more predictable earnings tend to have higher credit ratings. In recent work, Choi et al. (2015) present corroborating evidence suggesting that the relation between current accruals and future cash flows is stronger when managers have the higher ability. In a contemporary working paper, Baik et al. (2012) extend this literature by examining the direct impact of CEO ability on market-based measures of information asymmetry. While extent research points to a negative relation between ability and asymmetry, Baik et al. (2012) argue that there is also prior work which argues the opposite. For example, powerful CEOs may be able to extract rents in the form of higher equity compensation which is obscured by opaque financial disclosures (Bebchuk et al. 2002). However, based on regressions of information asymmetry measures on CEO ability, Baik et al. (2012) show that firms with higher ability CEOs have lower information asymmetry.

We posit that information risk is an important, albeit unexplored, channel that connects managerial ability with firm value through more efficient contracting with suppliers of credit and a lower cost of debt capital. We begin with the effect of ability on the firm's contracting environment as revealed by its choice of bond indenture covenants. According to Maxwell and Shenkman (2010), the three main objectives of covenants are to limit managerial discretion in undertaking new obligations that divert cash flows to competing claimants, issuing new debt that may dilute the claims of existing bondholders, and selling assets that transfer wealth to other claimants. A well-developed literature investigates analyzes a variety of firms and environmental characteristics associated with the structure and the restrictiveness of covenants.[1] Recent research delves into the impact of financial accounting characteristics and the role of accounting quality on the structure of debt contracts. For example, Sunder et al. (2008) show that accounting conservatism (i.e. more timely loss recognition) results in greater slack on net asset value-based covenants, while Frankel and Litov (2007) show that issuers are more likely to use accounting-based covenants when there is lower accounting discretion. More recently, classify covenants into two categories based on balance sheet information (capital covenants) and income or cash flow statement information (performance covenants), and contend these classifications control agency conflicts between shareholders and creditors in different ways. Capital covenants encourage greater *ex-ante* incentive alignment because they ensure a minimal level of equity that provides an incentive for shareholders to monitor managerial actions. In contrast, performance covenants detect early signs of financial distress based on current performance, allowing for control transfers and renegotiations if credit quality deteriorates. Christensen and Nikolaev (2012) argue that the quality of accounting information is a key consideration in the use of one type of covenant versus the other. When accounting information is a good indicator of credit quality, performance covenants are relatively less costly and more effective at reducing contracting frictions. For example, Christensen and Nikolaev (2012) report a positive association between proxies for timely loss recognition and earnings predictability and performance covenants. Conversely, when accounting information poorly describes credit quality, capital covenants are more effective at aligning shareholder and creditor interests. Following these arguments, we surmise that managerial ability affects the choice of performance versus capital covenants. To the extent that accounting information is contractible and greater ability managers provide higher quality information, higher managerial ability should increase (decrease) the relative efficiency and prevalence of performance (capital) covenants:

Hypothesis 1 Managerial ability is positively (negatively) associated with the use of performance (capital) covenants.

Following Diamond (1993), we examine the choice of maturity and seniority of debt as additional non-price characteristics that are affected by managerial ability. Prior theoretical work (e.g. Flannery 1986; Diamond 1993) argues that since long-term bond issues are more sensitive to informational asymmetry, high-quality firms may prefer to issue relatively less underpriced short-term debt. A variety of empirical work finds an inverse relation between information asymmetry and debt maturity. For example, Barclay and Smith (1995) find that firms with greater information asymmetry issue more short-term debt while Ortiz-Molina and Penas (2008) provide evidence that higher levels of information asymmetry are associated with shorter-term debt. Accounting quality is directly associated with debt maturity: Bharath et al. (2008) show that higher accounting quality is associated with longer-term debt issuance, and show that firms with poor accounting quality

[1] For example, Achleitner et al. (2012) explore the impact of information asymmetry costs and financial risk on covenant structure and restrictiveness, Billett et al. (2007) investigate how growth opportunities affect the firm's joint choice of leverage, maturity and covenants, while Hong et al. (2015) show that the use of covenants is related to the strength of the legal environment.

are more likely to issue shorter-term debt. This evidence extends to the syndicated loan market: Wittenberg-Moerman (2008) shows that syndicate lenders issue loans with shorter maturities to borrowers with higher bid-ask spread (i.e. are informationally opaque). To the extent that higher ability is associated with less information asymmetry, CEO quality should relate to the use of longer-term debt:

Hypothesis 2 Managerial ability is positively associated with the maturity of the firm's debt.

In a similar vein, we surmise that ability should be associated with a lower likelihood of issuing senior-status debt. A large theoretical literature (e.g. Stiglitz and Weiss 1981; Chan and Thakor 1987; Igawa and Kanatas 1990) point to a relationship between the use of loan collateralization and the mitigation of information asymmetry between the lender and borrower. For example, Igawa and Kanatas (1990) argue in credit markets that are characterized by asymmetric information, higher quality firms choose contracts that are over-collateralized. As Berger et al. (2005) summarize, "The theoretical models explain the use of collateral as a mechanism to reduce equilibrium credit rationing and other problems that arise due to asymmetric information between borrowers and lenders". Following this work, we surmise that if managerial ability plays a role in resolving *ex-ante* information asymmetry, firms with better-reputed CEOs should be less likely to rely on secured debt as a source of financing:

Hypothesis 3 Managerial ability is negatively associated with the use of senior secured debt.

We link the implications of *Hypotheses 1–3* to the pricing of information-sensitive debt. Bonsall et al. (2016) argue that the greater efficiency associated with higher managerial ability results in a lower variability of future performance which rating agencies interpret as a signal of lower default risk, and provide evidence that ability has an inverse association with the yield spreads of at-issue bonds. As the authors conclude, "our evidence supports the notion that managers matter in the assessment of default risk". Chen et al. (2017) present evidence suggesting that managers' ability heterogeneity enhances credit ratings. In a similar vein, Cornaggia et al. (2017) likewise find that managerial ability is significantly negatively related to the credit ratings and yield spreads of at-issue bonds, and the effect is stronger in firms facing financial distress and operating in competitive industries. Based on these findings, Cornaggia et al. (2017) conclude (p. 3) that "…managerial ability is a significant credit risk factor". In contrast to the credit risk explanation posed by these studies, we propose that the information quality attribute of managerial quality serves as a channel between ability and the market pricing of information-sensitive debt. A variety of studies (e.g. Han and Zhou 2014; Mansi et al. 2011; Butler 2008) show that information is efficiently priced by bond market participants; therefore, better accounting information related to managerial ability should be directly captured in the information component of yield spread, *ceteris paribus*. First, we surmise that improvements in the information environment negatively impact yield spreads through the default component of the spread: According to Vallascas and Keasey (2013), borrowers that are more difficult for investors to value are associated with greater default risk; therefore, higher quality information flow serves to lower yield spreads through its effect on perceptions of default. In recent work, Zer (2015) shows that banks' management can alleviate a deteriorating supply of public information by increasing their disclosure of private information, which in turn improves investors' assessment of bank default risk. This leads to the following hypothesis:

Hypothesis 4 The impact of managerial ability on yield spread is increasing in the level of default risk.

Second, we link managerial quality to the cost of debt capital through the liquidity component of spread. Diamond and Verrecchia (1991) show that reduction in information asymmetry increases demand for a firm's securities from significant shareholders due to improvements in future liquidity, thereby lowering its cost of capital. Similarly, Leuz and Verrecchia (2000) find a positive relation between corporate disclosure and stock liquidity. In more recent empirical work, Ng (2008) investigates the role of information quality (i.e. publicly available information) in mitigating liquidity risk. Ng (2008) shows that better information quality is associated with lower liquidity risk and that a firm's cost of capital is lower due to the effect of higher information quality in lowering liquidity risk. Ascioglu et al. (2012) document that earnings manipulation and lower reporting quality lead to lower liquidity. Therefore, we hypothesize that improvements in the information environment associated with higher ability negatively impact yield spreads through the liquidity component of yield spread:

Hypothesis 5 The impact of managerial ability on yield spread is increasing in the level of bond illiquidity.

3 Data

Our measure of executive team ability is based on the *MA-Score* measure developed by Demerjian et al. (2012), who decompose total firm efficiency (i.e. the ability to generate more revenues from a given set of inputs) into components related to firm characteristics (e.g. size) and to the skill of the management team. Demerjian et al. (2012) assess the robustness of their measure by demonstrating that the departures of low (high) quality CEOs are associated with positive (negative) abnormal stock price reactions and that high (low) quality CEO replacements are related to higher (lower) subsequent firm performance. The *MA-Score* has the additional advantage of being available for a broad cross-section of firms. We use this variable as our primary measure of managerial ability due to its superior power to capture CEO efficiency.

In the preliminary analysis, we examine if there is cross-sectional variation in the effects of *MA-Score* and the quality of the firm's information environment. We measure information asymmetry alternatively with the following three measures. First, mean bid-ask spread (BAS) is calculated as the calendar year average of $(Ask_{i,t} - Bid_{i,t})/M_{i,t}$, where $Ask_{i,t}$ and $Bid_{i,t}$ are the daily closing stock ask and bid prices for firm i on day t and $M_{i,t}$ is the mean of the corresponding ask and bid prices.[2] Second, idiosyncratic return volatility (*Ln*(*IV*)) is the logged standard deviation of the residuals based on calendar year regressions of weekly stock returns on weekly value-weighted CRSP market index returns and value-weighted

[2] Chung and Zhang (2014) show that this *CRSP*-based bid-ask spread measure is a very good approximation of the bid-ask spread obtained using intraday price data.

Fama–French 49 industry returns. Finally, we use the probability of informed trading (PIN).[3]

We empirically explore the relation between managerial ability and the terms and pricing of corporate bonds outlined by *Hypotheses 1–5* using data drawn from multiple sources. The sample period covers fiscal years 1994–2013, based on the availability of the *MA-Score* measure.[4] To test the non-price characteristics pertaining to *Hypotheses 1–3* (covenant structure, maturity, and seniority), we analyze at-issue corporate bonds from the Thomson Financial SDC Platinum database. The SDC database contains the issuer and issue CUSIP, par amount of the issue, offering date, security status and seniority, credit rating, maturity, among other details. To ensure consistency with the ensuing yield spread analysis, we exclude convertibles, bonds for which there is no conventional yield to maturity (e.g. floating and step-up coupon bonds), and bonds with synthetic features and exotic structures. Since information flow may be different in regulated industries, we exclude issuers classified as financial ($6000 \leq SIC \leq 6999$) and utilities ($4900 \leq SIC \leq 4999$).

We obtain information about each bond's covenant package from the Mergent Fixed Income Security Database (FISD) Issues file, which contains over 50 variables pertaining to issuer/subsidiary restrictive and bondholder protective covenants. The FISD Issues file matches to approximately 30–50% of the bonds in the SDC database, depending on the precision of the matching process. Based on the findings of De Franco et al. (2015) who show that bonds issued by the same firm tend to have similar structures, we first match on the bases of issuer and year to obtain the broadest sample size. Second, we match on the bond level using issue, year, coupon, offering date, and maturity date, which improves the precision of the matched sample at the expense of a smaller number of observations.

We use yield spreads associated with secondary market transactions to examine *Hypotheses 4–5*. We use the FISD Issues file as the source of credit ratings and other bond-level characteristics. We combine two sources of transaction-level bond price data. First, FISD provides details corresponding to individual daily corporate bond transactions by insurance companies (actual cost and par amount of each transaction, if the transaction is a buyer- or seller-initiated, and broker identification) for the 1994–2011 period. Second, the Trade Reporting and Compliance Engine (*TRACE*) provides secondary market transactions for investment grade and high yield debt beginning in 2002. We aggregate these databases and eliminate any duplicate transactions. We convert individual transactions reported in *TRACE* and FISD to an aggregate trade-weighted daily yield to maturity using the par amounts of each transaction as weights. We calculate a daily yield spread as the difference between the trade-weighted yield to maturity based on the corporate bond's flat price and, following the procedure outlined above, the corresponding interpolated yield to maturity with the same time to maturity from the Treasury yield curve. We use the fiscal year-end (FYE) date of the sample firms as the reference point to test the effect of *MA-Score* on yield spread. For each firm-year, we use the yield spread of the closest trade-day to the FYE date using a window of (− 180, + 180) days where day-zero is the FYE date.

3 We obtain the PIN measure from Stephen Brown's website, at http://scholar.rhsmith.umd.edu/sbrown/pin-data. The measure is available for the 1993–2010 period.

4 We obtain the *MA-Score* measure from Sarah McVay's website, at http://faculty.washington.edu/smcvay/abilitydata.html.

4 Empirical approach and results

4.1 Managerial ability and information asymmetry

An extensive line of research examines the role of analysts as information intermediaries and the usefulness of their outputs (e.g. price targets and earnings forecasts) to investors. As Li and You (2015) discuss, one of the channels through which analyst coverage adds value is by reducing the cost of capital. Analyst forecasts or recommendations may directly reduce the cost of capital by supplying useful information to investors. A second, but not necessarily mutually exclusive, mechanism that ties analyst coverage to the cost of capital is investor recognition. Based on Merton's (1987) premise that investor recognition is directly correlated with stock demand, a line of research (e.g. Mola et al. 2013) shows that greater analyst coverage facilitates greater recognition of the covered stocks, thereby increasing stock value and reducing the cost of capital. Following these lines of work, analyst coverage should have a negative correlation with the degree of asymmetry surrounding the firm. Further, we surmise that when analyst coverage is low, executive team ability becomes more important in satisfying investor demand for information and by helping improve investor recognition of the company's stock.

In Table 1, we provide coefficient estimates of alternative measures of information asymmetry on interactions between the *MA-Score* and the logged number of analyst estimates, along with additional control variables that explain the quality of the information environment. We specify the model as follows:

$$\begin{aligned} Asymmetry\ measure_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Log\ (No.\ Estimates) + \alpha_3 MA \\ & - Score \times Log(No.Estimates)_{i,t} + \alpha_4 Firm\ quality\ rating_{i,t} \\ & + \alpha_5 Log(Turnover)_{i,t} + \alpha_6 Debt\ ratio_{i,t} + \alpha_7 Firm\ size_{i,t} \\ & + \alpha_8 Market - book\ ratio_{i,t} + \alpha_9 Std.(EBIT/Assets)_{i,t} \\ & + \alpha_{10} Log(Firm\ age)_{i,t} + \alpha_{11} R\&D\ Expense_{i,t} + \alpha_{12} HHI_{i,t} \\ & + \alpha_{13} Sales\ growth_{i,t} + Fama - French\ 49\ industry\ fixed\ effects_j \\ & + Year\ fixed\ effects_t + e_{i,t} \end{aligned} \tag{1}$$

We employ alternative measures of information asymmetry, including: logged stock idiosyncratic volatility (e.g. Chenet al. 2012; Kang and Nam 2015), mean stock bid-ask spread (e.g. Leuz and Verrecchia 2000; Yohn 1998), the probability of informed trading (e.g. Brown and Hillegeist 2007), and an asymmetry index based on the first principal component of these three measures (PC1). The additional control variables control for additional firm- and industry-level characteristics that contribute to asymmetry: stock trading turnover (*Logged turnover*), cash flow predictability (*Firm quality rating*, *Debt ratio*, *Firm size*, *Std.* (*EBIT/Assets*), logged *Firm age*), growth prospects (*Market-book ratio*, *R&D Expense*), and degree of competition within the firm's industry (*HHI*). We describe the construction of these measures in more detail in Appendix 1. We also control for unobservable effects related to (Fama–French 49) industry and year.

Table 1 illustrates the coefficient estimates corresponding to Eq. (1). The *MA-Score* and logged analyst estimates generally have the expected effects on the asymmetry measures. More importantly, the interactions between *MA-Score* and analyst coverage are significantly positive for all three asymmetry measures as well as for the asymmetry index. This provides preliminary evidence that executive team characteristics add value by providing

Table 1 Managerial ability and information asymmetry

	Model (1) Ln(IV)	Model (2) Ln(IV)	Model (3) BAS	Model (4) BAS	Model (5) PIN	Model (6) PIN	Model (7) PC1	Model (8) PC1
MA-Score	− 0.0155***	− 0.0409***	− 0.0034**	− 0.0202***	− 0.0018	− 0.0308**	− 0.2354***	− 0.8971***
	(0.000)	(0.000)	(0.021)	(0.000)	(0.709)	(0.024)	(0.000)	(0.000)
Log (No. estimates)	− 0.0047***	− 0.0047***	0.0000	− 0.0000	− 0.0098***	− 0.0097***	− 0.0930***	− 0.0922***
	(0.000)	(0.000)	(0.999)	(0.987)	(0.000)	(0.000)	(0.000)	(0.000)
MA-Score × Log (No. Estimates)		0.0136***		0.0090***		0.0159***		0.3626***
		(0.000)		(0.000)		(0.008)		(0.000)
Firm quality rating	− 0.0048***	− 0.0048***	− 0.0008***	− 0.0008***	− 0.0044***	− 0.0044***	− 0.0766***	− 0.0770***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (Turnover)	0.0055***	0.0055***	− 0.0048***	− 0.0047***	− 0.0401***	− 0.0400***	− 0.2041***	− 0.2029***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt ratio	0.0264***	0.0265***	0.0113***	0.0114***	0.0366***	0.0366***	0.6113***	0.6126***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size	− 0.0061***	− 0.0061***	− 0.0031***	− 0.0031***	− 0.0246***	− 0.0247***	− 0.2264***	− 0.2267***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-book ratio	− 0.0009*	− 0.0009*	− 0.0015***	− 0.0015***	− 0.0093***	− 0.0093***	− 0.0723***	− 0.0737***
	(0.078)	(0.066)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Std. (EBIT/assets)	0.0421***	0.0416***	0.0118***	0.0115***	− 0.0006	− 0.0012	0.5832***	0.5712***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.960)	(0.926)	(0.000)	(0.000)
Log (firm age)	− 0.0033***	− 0.0032***	0.0001	0.0001	− 0.0024*	− 0.0024*	− 0.0389***	− 0.0373***
	(0.000)	(0.000)	(0.692)	(0.547)	(0.053)	(0.061)	(0.000)	(0.000)
R&D expenditure	0.0004***	0.0004***	− 0.0001	− 0.0001	0.0004	0.0004	0.0019	0.0015
	(0.004)	(0.004)	(0.121)	(0.105)	(0.516)	(0.532)	(0.692)	(0.750)
HHI	0.0048***	0.0049***	0.0008	0.0008	− 0.0087*	− 0.0086*	0.0232	0.0263
	(0.007)	(0.007)	(0.466)	(0.440)	(0.066)	(0.072)	(0.613)	(0.568)
Sales growth	0.0017	0.0019	− 0.0013*	− 0.0011	0.0014	0.0017	0.0069	0.0135
	(0.255)	(0.190)	(0.066)	(0.112)	(0.644)	(0.573)	(0.774)	(0.571)
Fama–French 49 fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1 (continued)

	Model (1) Ln(IV)	Model (2) Ln(IV)	Model (3) BAS	Model (4) BAS	Model (5) PIN	Model (6) PIN	Model (7) PC1	Model (8) PC1
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	302.23	302.07	172.50	172.93	399.19	397.08	451.88	454.65
R-square	0.48	0.48	0.46	0.47	0.61	0.61	0.65	0.65
No. Obs.	35,822	35,822	35,840	35,840	26,392	26,392	26,358	26,358

Table 1 provides *MA-Score* coefficient estimates using alternative measures of information asymmetry as the dependent variable. Appendix 1 provides the variable descriptions and construction details. Coefficient p-values based on two-way clustered standard errors are in parentheses

***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively

information demanded by investors and this role becomes more important when analysts provide less information intermediation.

4.2 The impact of managerial ability on covenant structure, maturity, and seniority

We test the effect of managerial ability on debt characteristics relating to *Hypotheses 1–3*. The final sample of bonds with a complete set of non-missing control variables consists of 5670 bond observations issued by 1195 unique firms. Appendix 2 Panels A–B provides descriptive bond-level summary statistics for these bonds and Panel C provides issuer-level characteristics. The *Performance covenant index* varies from 0 to 3 according to whether the indenture includes fixed charge coverage-, subsidiary fixed charge coverage-, and net earnings test covenants. The *Capital covenant index* varies from 0 to 6 based on the following covenants: investments, subsidiary investments, issue of senior debt, leverage test, issue of common and preferred stock, and stock transfers. The *Total covenant index* is the sum of all capital and performance covenants for a given bond. To measure the relative intensity of performance covenants relative to capital covenants, we compute *Covenant Structure* as the ratio of the *Performance*- and *Capital covenant* indices. The distributions of both covenant types are highly skewed, based on mean (standard deviation) values for the total, capital, and performance indices of 0.82 (1.16), 0.34 (0.77), and 0.47 (0.85), respectively. Therefore, we log the sum of one plus each measure in the ensuing cross-sectional analysis.

Following the prediction of *Hypothesis 1* that accounting quality improves the efficiency of performance covenants, we examine if managerial ability affects the relative balance of capital to performance covenants using the following model:

$$
\begin{aligned}
Covenant\ index_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Firm\ size + \alpha_3 Market - book\ ratio_{i,t} \\
& + \alpha_4 EBIT \big/ Assets_{i,t} + \alpha_5 Loss\ dummy_{i,t} + \alpha_6 Advertising\ expense_{i,t} \\
& + \alpha_7 R\&D\ expenditure_{i,t} + \alpha_8 Asset\ tangibility_{i,t} + \alpha_9 Z - score_{i,t} \\
& + \alpha_{10} Debt\ ratio_{i,t} + \alpha_{11} Stock\ volatility_{i,t} + \alpha_{12} Std.(EBIT / Assets)_{i,t} \\
& + \alpha_{13} Time\ to\ maturity_{i,t} + \alpha_{14} Yield\ slope_{i,t} + \alpha_{15} High\ yield_{i,t} \\
& + \alpha_{16} Default\ spread_{i,t} + Fama - French\ 49\ industry\ fixed\ effects_j \\
& + Year\ fixed\ effects_t + e_{i,t}
\end{aligned}
\tag{2}
$$

Covenant index is the logged sum of all capital and performance covenants for a given bond, respectively. With respect to the additional independent variables in Eq. 1, logged total assets control for firm size. Christensen and Nikolaev (2012) argue that growth opportunities have an effect on the covenant structure; we control for growth opportunities with multiple metrics including *Market-book ratio*, *R&D expenditure,* and *Advertising expenditure*. *EBIT/Assets* and *Loss* represent profitability and a binary variable for negative net income, respectively, while *Std. EBIT/Assets* and *Stock volatility* gauge cash flow risk associated with volatility in earnings and stock returns. Christensen and Nikolaev (2012) find that firms with greater *Asset tangibility* are more likely to rely on capital covenants. We control for leverage with *Debt ratio* and for issuer creditworthiness with *Z-score* and, alternatively, *Bond rating*. *Z-score* is a financial ratio-based measure of proximity to bankruptcy and is calculated according to the formulation described by Altman (1968), and we convert Moody’s letter bond ratings to numerical equivalents ranging from 21 (“C”) to 1 (“Aaa”) to obtain the *Bond rating* measure. *Time to maturity* controls for bond-specific effects related to maturity. We control for the interest rate environment with the slope of the yield curve and the volatility of the slope. *Yield curve slope* is calculated as the difference between 10-year and 3-month US Treasury yields on the month of the offering date, and interest rate uncertainty (*Std. slope*) is calculated as the standard deviation of the yield curve slope estimated over the 6 months prior to the offering date. Finally, the Baa–Aaa index spread (*Default spread*) proxies for the bargaining position of investors to demand covenant protection on new corporate debt. We include year fixed effects to control for the impact of secular time trends on covenant structure and Fama–French 49 indicator variables to control for fixed effects related to industry. Appendix 1 provides additional details regarding the construction of the control variable details.

We provide coefficient estimates for Eq. 2 in Table 2 based on the firm-level merge of the FISD Issues file to the SDC dataset. We calculate robust standard errors that are cluster-adjusted at the firm and year levels. In Model 1, *MA-Score* has a negative, albeit insignificant, relationship with *Covenant index*. In Models 2–3, we decompose the *Covenant index* into its capital- and performance- components, respectively. In support of *Hypothesis 1* and the intuition that management team characteristics affect the contracting environment with outside investors, the *MA-Score* coefficient estimate is negatively related to the logged number of capital covenants at the 1% level (Model 2) and positively related to the logged number of performance covenants at the 10% level (Model 3). In Model 4, we calculate *Covenant structure* as the logged ratio of capital- to performance covenants. *MA-Score* is negative and significant at the 1% level, demonstrating that ability affects the balance of capital and performance covenants. Consistent with the predictions of *Hypothesis 1* and the view that higher ability managers enhance the contracting efficiency with outside investors, increasing *MA-Score* is associated with a higher (lower) frequency of performance (capital) covenants.

Hypothesis 2 predicts that managerial ability is directly associated with debt maturity. To test this hypothesis, we estimate the following model:

$$\begin{aligned} Debt\ maturity_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Market - book\ ratio + \alpha_3 Firm\ size_{i,t} \\ & + \alpha_4 Asset\ maturity_{i,t} + \alpha_5 Debt\ ratio_{i,t} + \alpha_6 Rating_{i,t} + \alpha_7 Rating^2_{i,t} \\ & + \alpha_8 Yield\ curve\ slope_{i,t} + \alpha_9 Std.(Yield\ curve\ slope)_{i,t} \\ & + Fama - French\ 49\ industry\ fixed\ effects_j \\ & + Year\ fixed\ effects_t + e_{i,t} \end{aligned} \tag{3}$$

We measure debt maturity with the number of years to maturity of newly issued bonds (*Time to maturity*). In addition to *MA-score*, the remaining explanatory variables are based on explanations related to contracting costs, signaling, and taxation related to the slope of the yield curve and the uncertainty of interest rates. Myers (1977) posits that short-term debt is a solution to underinvestment problems. Barclay and Smith (1995) provide empirical support for this view by showing that firms with growth opportunities prefer short-term debt while mixed support for this relation is provided by Stohs and Mauer (1996). In a similar vein, larger firms are more likely to have lower agency problems related to debt; consistent with this view, firm size should be positively related to debt maturity. We measure growth opportunities with *Market-book ratio*, defined as total liabilities plus market capitalization of equity divided by total assets, and *Firm size* as the log of total assets. The signaling explanation of debt maturity (e.g. Flannery 1986) argues that in an asymmetric information environment, lower quality firms prefer to issue long-term debt which may be mispriced relative to short-term debt. We measure firm quality with *Bond rating*

Table 2 Managerial ability and covenant structure

	Model (1) covenant index	Model (3) capital covenants	Model (3) performance covenants	Model (4) covenant structure
MA-Score	− 0.1927*	− 0.3276***	0.1349*	− 0.3177***
	(0.089)	(0.000)	(0.057)	(0.000)
Firm size	− 0.0002	− 0.0114	0.0113	− 0.0152
	(0.993)	(0.388)	(0.325)	(0.198)
Market-book ratio	0.0247	− 0.0213	0.0461***	− 0.0451***
	(0.448)	(0.292)	(0.010)	(0.001)
EBIT/assets	0.3304	0.4144*	− 0.0840	0.3176*
	(0.372)	(0.069)	(0.705)	(0.067)
Loss dummy	0.0215	0.0145	0.0070	0.0020
	(0.632)	(0.716)	(0.788)	(0.956)
Advertising expenditure	0.5697	0.4581	0.1116	0.2033
	(0.414)	(0.412)	(0.821)	(0.713)
R&D expenditure	− 0.0443	− 0.0856	0.0414	− 0.0676
	(0.905)	(0.693)	(0.857)	(0.694)
Asset tangibility	0.1387	0.0929	0.0458	0.0160
	(0.276)	(0.406)	(0.385)	(0.843)
Z-Score	− 0.0035	0.0073	− 0.0108	0.0122
	(0.851)	(0.555)	(0.450)	(0.348)
Debt ratio	0.5949***	0.3854***	0.2096**	0.1131
	(0.000)	(0.004)	(0.020)	(0.356)
Stock volatility	− 0.0200	0.0395	− 0.0595	0.0598
	(0.815)	(0.533)	(0.246)	(0.244)
Std. (EBIT/assets)	0.4699	0.2828	0.1871	0.0675
	(0.436)	(0.576)	(0.476)	(0.850)
Time to maturity	− 0.0003	− 0.0006	0.0002	− 0.0005
	(0.774)	(0.504)	(0.785)	(0.571)
Yield curve slope	0.0171	0.0244**	− 0.0073	0.0201*
	(0.305)	(0.016)	(0.579)	(0.080)
Std. slope	0.0665	0.0255	0.0410	− 0.0114
	(0.428)	(0.730)	(0.474)	(0.870)
Bond rating	− 0.0456***	− 0.0386***	− 0.0069	− 0.0226***
	(0.000)	(0.000)	(0.135)	(0.000)
Aaa–Baa default spread	0.0211**	0.0002	0.0208	− 0.0133
	(0.026)	(0.966)	(0.166)	(0.326)
Fama–French 49 fixed effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
F-statistic (Chi square)	2.43	67.77	0.37	2.49
R-square (pseudo *R*-square)	0.44	0.32	0.60	0.53
No. Obs.	4229	4229	4229	4229

Table 2 presents the relation between managerial ability and covenant structure of newly issued bonds for the sample period January 1994 to December 2013. Models 1 and 5 use the logged covenant index as the dependent variable, Models 2 and 6 use the logged capital covenant index, Models 3 and 7 use the logged performance covenant index, and Models 4 and 8 use the logged ratio of performance-to-capital covenants as the dependent variables, respectively. Appendix 1 provides the variable descriptions and construction details. Coefficient *p*-values based on two-way clustered standard errors are in parentheses

***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively

Table 3 Debt maturity, senior status, and managerial ability

	Model (1) time to maturity	Model (2) senior secured dummy
MA-Score	2.1240**	− 1.4805***
	(0.036)	(0.005)
Market-book ratio	0.2784*	− 0.2494***
	(0.054)	(0.001)
Firm size	− 0.2190	− 0.3125*
	(0.296)	(0.067)
Asset maturity	0.0888**	− 0.0165
	(0.033)	(0.285)
Debt ratio	− 0.7448	1.1957***
	(0.462)	(0.000)
Bond rating	1.3386***	− 0.0930
	(0.000)	(0.554)
Bond rating^2	− 0.0435***	− 0.0023
	(0.000)	(0.805)
Yield curve slope	− 0.3492	
	(0.183)	
Std. slope	0.1313	
	(0.942)	
Lagged ROA		− 1.7127***
		(0.000)
Prior stock return		0.2556
		(0.180)
Fama–French 49 fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
F-statistic (Chi square)	10.43	451.96
R-square (pseudo *R*-square)	0.08	0.40
No. Obs.	5670	4755

Table 3 presents the relation between managerial ability, debt maturity structure (Models 1–4) and seniority status (Models 5–6) of newly issued bonds for the sample period January 1994 to December 2013. Appendix 1 provides the variable descriptions and construction details. Coefficient *p*-values based on two-way clustered standard errors are in parentheses

. ***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively

and control for potential nonlinearities with *Rating*^{2}. Finally, according to Brick and Ravid (1985), the term structure of interest rates reflects the relative advantage of long-term debt: when the yield curve is steeper, long-term debt brings a relatively greater tax advantage due to a higher present value of the interest rate tax shield. Brick and Ravid (1991) further argue that long-term debt is advantageous even when the yield curve is flat if future interest rates are uncertain. Accordingly, we include *Yield curve slope* and *Std. (Yield curve slope)* as defined above. The coefficient estimates for Eq. 3 are presented in Table 3. In support of the prediction of *Hypothesis 2* that better quality information associated with higher quality managers lead issuing firms to choose longer-maturity debt, *MA-Score* is positive and significant at the 5% level.

We examine *Hypothesis 3* using the following probit model where the dependent variable is a binary variable equal to one if the bond is senior secured and zero otherwise:

$$\begin{aligned} Senior\ secured_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Market - book\ ratio + \alpha_3 Firm\ size_{i,t} \\ & + \alpha_4 Asset\ maturity_{i,t} + \alpha_5 Debt\ ratio_{i,t} + \alpha_6 Rating_{i,t} \\ & + \alpha_7 Rating^2_{i,t} + \alpha_8 Lagged\ ROA_{i,t} + \alpha_9 Lagged\ stock\ return_{i,t} \\ & + Fama - French\ 49\ industry\ fixed\ effects_j + Year\ fixed\ effects_t \\ & + e_{i,t} \end{aligned} \tag{4}$$

Based on prior theoretical work predicting a lower likelihood of secured loan issuance when information asymmetry is lower, we expect the *MA-score* to reduce the likelihood of senior secured debt issuance. With respect to the control variables, there is a limited body of work on the empirical determinants of the debt security. Julio et al. (2007) point to 'corporate finance' and 'banking' views for motives to issue secured debt. The former view argues that higher quality firms use secured debt to avoid investment inefficiencies associated with unsecured debt (e.g. Smith and Warner 1979; Berkovitch and Kim 1990). The latter view argues that low-quality issuers use secured debt because they cannot obtain financing otherwise (e.g. Berger and Udell 1990). Julio et al. (2007) provide empirical evidence supporting the 'banking' view: poor quality firms with lower growth options are more likely to issue secured debt. Based on these findings, we use *Bond rating* and *Market-book ratio* to gauge firm performance and growth opportunities, respectively. Julio et al. (2007) find that additional measures of financial distress significantly explain the secured debt choice: smaller firms, those with greater leverage, and firms with limited growth options and poor prior performance leading up to the issue date are more likely to issue secured debt. Accordingly, we include *Firm size* and *Debt ratio* as control variables. We measure prior financial performance with two measures: *ROA* measured the fiscal year prior to the issue date, and the cumulated daily stock return for the 200 days leading up to the issue date. In addition, Chen et al. (1998) show that secured loan issuance is related to asset riskiness and loan size: to the extent that longer-maturity assets are viewed as riskier, *Asset maturity* should be positively related to the use of secured loans. Finally, we include the logged *Issue size* to control for the size of the loan.

The coefficient estimates for Eq. 4 are presented in Table 3, Model 2. Based on a large theoretical literature pointing to the use of loan collateralization as a means of mitigating information asymmetry between lenders and borrowers, *Hypothesis 3* predicts managerial ability should be negatively associated with the likelihood that the firm issues senior secured debt. In support of *Hypothesis 3*'s prediction that firms are less likely to choose secured debt when managerial ability is higher, the *MA-Score* coefficient estimate is negative and significant at the 1% level.

4.3 The pricing of managerial ability

Hypotheses 4–5 predict the pricing of bonds is conditional on the information sensitivity of the debt contract. First, we provide a preliminary univariate analysis of the association between *MA-Score* and the cost of debt according to the level of default risk. Using the Moody's bond rating as the measure of default risk, we create six rating categories beginning with bonds rated C–Caa through Aa–Aaa. Within each of these categories, we sort the sample by *MA-Score* quartiles based on the yearly distributions of *MA-Score*. This creates variation in *MA-Score* that is independent of default risk as defined by each rating category. We calculate a weighted average yield spread for each firm using the par amounts of individual bonds as weights. Table 4 shows that mean and median yield spread monotonically improves from the lowest to the highest quartile of *MA-Score* within each rating category, providing support for the intuition that managerial ability has an effect on yield spread independently of the risk of default as measured by the bond rating. In the final column, we provide *p*-values for whether the difference in mean (median) yield spread between top and bottom *MA-Score* quartiles for each row is significant using the *t*-(Wilcoxon) statistic. Consistent with our expectation, higher *MA-Score* has a greater impact on lower-rated bonds compared to higher rated bonds; for example, the median difference in yield spread between the highest and lowest quartile *MA-Score* for B-rated bonds is 48 basis points, compared to 13 basis points for A-rated bonds. These results provide preliminary support for *Hypothesis 4*: The impact of *MA-Score* on yield spread intensifies in the level of default risk.

We control for additional bond- and firm characteristics that affect yield spread by estimating the following least-squares regression model over the 1994–2013 sample period:

$$\begin{aligned} Log(Yield\ spread)_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Default\ measure + \alpha_3 MA \\ & - Score \times Default\ measure_{i,t} + \alpha_4 Duration_{i,t} + \alpha_5 Callable_{i,t} \\ & + \alpha_6 Puttable_{i,t} + \alpha_7 Subordinate_{i,t} + \alpha_8 Log(Issue\ amount)_{i,t} \\ & + \alpha_9 Debt\ ratio_{i,t} + \alpha_{10} EBIT/Assets_{i,t} + \alpha_{11} Std.(EBIT/Assets)_{i,t} \\ & + \alpha_{12} Capital\ expenditure_{i,t} + \alpha_{13} Firm\ size_{i,t} + \alpha_{14} Sales\ growth_{i,t} \\ & + \alpha_{15} Stock\ beta_{i,t} + \alpha_{16} Lagged\ stock\ return_{i,t} + Fama \\ & - French\ 49\ industry\ fixed\ effects_j + Year\ fixed\ effects_t + e_{i,t} \end{aligned} \quad (5)$$

Consistent with related work, we control for credit risk using variables at the issue and firm levels and, similar to Eqs. 1–4, we control for unobservable effects related to industry and time with Fama–French 49 industry and year indicator variables. The Moody's bond rating serves as our primary measure of default. Following the results of Table 4, we expect that the effect of *MA-Score* on yield spread is increasing in lower credit quality.

With respect to the bond-level control variables, we control for maturity and coupon effects with modified duration, defined as the first derivative of the price-yield function evaluated at the current yield to maturity divided by price. Mansi et al. (2004) argue that riskier firms tend to issue shorter bonds with higher coupon payments, implying an inverse relation between *Duration* and yield spread. We control for the effects of embedded call and put options using the binary variables *Callable* and *Puttable*, respectively. *Subordinate* is an indicator variable equal to one if the bond is subordinate to other debt issues. Finally, the logged value of the par amount of issued bonds controls for economies of scale in underwriting and liquidity that are associated with issue size (e.g. Bhojraj and Sengupta 2003). The firm-level variables represent various dimensions of profitability and cash flow risk and are drawn from an extensive literature that examines determinants of the cost of corporate debt (e.g. Mansi et al. 2011; Klock et al. 2005; Ortiz-Molina and Penas 2008). *Debt ratio* measures the proportion of debt in the capital structure. We measure profitability with *EBIT/Assets*, and the 5-year standard deviation of *EBIT/Assets* controls for cash flow risk. *Capital expenditure* controls for future cash flow growth, while we measure firm size effects with logged total assets. *Sales growth* is the geometric growth in sales over the prior 5 years and reflects growth opportunities. Finally, we include two control measures

Table 4 Mean (median) values of weighted average yield spread by bond rating categories

Panel A: two-way sorts using bond rating and MA-Score	(Q4–Q1)					
bond rating	MA-Score Q1	MA-Score Q2	MA-Score Q3	MA-Score Q4	Difference	*p* value
Aa3–Aaa	0.0195	0.0183	0.0190	0.0177	− 0.0018	0.503
	(0.0136)	(0.0136)	(0.0143)	(0.0135)	(− 0.0001)	(0.778)
	[430]	[419]	[428]	[416]		
A3–A1	0.0285	0.0245	0.0256	0.0244	− 0.0041***	0.005
	(0.0212)	(0.0207)	(0.0203)	(0.0199)	(− 0.0013)***	(0.005)
	[693]	[683]	[689]	[675]		
Baa3–Baa1	0.0467	0.0463	0.0423	0.0404	− 0.0063***	0.007
	(0.0388)	(0.0367)	(0.0375)	(0.0367)	(− 0.0021)**	(0.043)
	[383]	[370]	[376]	[366]		
B3–B1	0.0676	0.0667	0.0616	0.0601	− 0.0076**	0.018
	(0.0546)	(0.0533)	(0.0508)	(0.0498)	(− 0.0048)***	(0.000)
	[579]	[566]	[574]	[561]		
C–Caa	0.1458	0.1340	0.1326	0.1164	− 0.0294	0.103
	(0.0911)	(0.0811)	(0.0775)	(0.0783)	(− 0.0128)*	(0.055)
	[137]	[125]	[133]	[119]		

Panel B: two-way sorts using trading volume rating and MA-Score	(Q4–Q1)					
Volume quartile	MA-Score Q1	MA-Score Q2	MA-Score Q3	MA-Score Q4	Difference	*p*-value
Q4 (highest)	0.0358	0.0318	0.0292	0.0268	− 0.0090***	0.002
	(0.0232)	(0.0209)	(0.0206)	(0.0196)	(− 0.0036)***	(0.002)
	[571]	[559]	[567]	[553]		
Q3	0.0509	0.0427	0.0399	0.0321	− 0.0188***	< 0.000
	(0.0378)	(0.0316)	(0.0274)	(0.0253)	(− 0.0125)***	(< 0.000)
	[572]	[564]	[570]	[557]		

Table 4 (continued)

Panel B: two-way sorts using trading volume rating and MA-Score	(Q4–Q1)					
Volume quartile	MA-Score Q1	MA-Score Q2	MA-Score Q3	MA-Score Q4	Difference	*p*-value
Q2	0.0542	0.0462	0.0410	0.0388	− 0.0153***	< 0.000
	(0.0403)	(0.0336)	(0.0308)	(0.0289)	(− 0.0114)***	(< 0.000)
	[571]	[562]	[568]	[555]		
Q1 (lowest)	0.0716	0.0512	0.0453	0.0433	− 0.0284***	< 0.000
	(0.0441)	(0.0374)	(0.0318)	(0.0324)	(− 0.0117)***	(< 0.000)
	[573]	[565]]	[572]	[559]		

Table 4 reports mean (median) firm-level weighted average yield spreads following two-way sorts, first by Moody's bond rating categories and then by *MA-Score*, using the 32,089 observations used in the transaction-level yield spread regression models. The number of firm-level observations for each subset is provided in brackets

***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively

based on the issuer's stock: *Stock beta* reflects systematic exposure to macroeconomic fluctuations while *1-year stock return* is an alternative market-based measure of profitability. Appendix 1 provides further details about the construction of these variables and Appendix 3 provides bond- and firm-level summary statistics.

In Table 5 Model 1, we estimate Eq. 5 using the main effects (*Bond rating* and *MA-Score*) only, and in Model 2 we include the *MA-Score* × *Bond rating* interaction to test if the slope of *MA-Score* significantly varies over Moody's bond rating levels. In Model 2, the interaction is negative and significant at the 5% level, providing preliminary evidence that *MA-Score* has a significantly stronger impact on yield spread when bonds have lower ratings after controlling for other factors that also affect yield spread.

According to *Hypothesis 5*, the effect of managerial ability on yield spread is increasing in bond illiquidity. Similar to our preliminary examination of *Hypothesis 4*, we begin with a univariate analysis of the association between *MA-Score* and the cost of debt within illiquidity quartiles. Lower bond trading volume, as gauged by the aggregate dollar trading volume over the transaction year, represents additional liquidity risk. Using the distribution of trading volume in each year, we first create four liquidity categories based on quartiles of *Bond trading volume*. Within each of these quartiles, we sort the sample by *MA-Score* and calculate the firm-level weighted average bond yield spread for each *MA-Score* quartile. Table 4 Panel B demonstrates that mean and median yield spread improve from the lowest to the highest quartile of *MA-Score* within each *Bond trading volume* quartile, demonstrating that *MA-Score* affects yield spread independently of the level of liquidity risk. Consistent with the prediction of *Hypothesis 4*, the impact of *MA-Score* is generally increasing in *Bond trading volume*. For example, the difference in median yield spread between the highest and lowest quartile *MA-Score* for bonds in the lowest *Bond trading volume* quartile is 36 basis points, compared to 117 basis points for bonds in the highest volume quartile. Overall, these results provide preliminary support for *Hypothesis 4*: *MA-Score* reduces risk independent of liquidity, and the impact increases as illiquidity becomes greater.

In Table 5 Panel B, we conduct a series of cross-sectional regressions of yield spread on *MA-Score* and interactions with alternative measures of bond illiquidity. Similar to Eq. 5, we specify the model as follows:

$$\begin{aligned}
Log(Yield\ spread)_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Liquidity\ measure_{i,t} + \alpha_3 MA \\
& - Score \times Liquidity\ measure_{i,t} + \alpha_4 Duration_{i,t} + \alpha_5 Callable_{i,t} \\
& + \alpha_6 Puttable_{i,t} + \alpha_7 Subordinate_{i,t} + \alpha_8 Log(Issue\ amount)_{i,t} \\
& + \alpha_9 Debt\ ratio_{i,t} + \alpha_{10} EBIT/Assets_{i,t} + \alpha_{11} Std.(EBIT/Assets)_{i,t} \\
& + \alpha_{12} Capital\ expenditure_{i,t} + \alpha_{13} Firm\ size_{i,t} + \alpha_{14} Sales\ growth_{i,t} \\
& + \alpha_{15} Stock\ beta_{i,t} + \alpha_{16} Lagged\ stock\ return_{i,t} + Fama \\
& - French\ 49\ industry\ fixed\ effects_j + Year\ fixed\ effects_t + e_{i,t}
\end{aligned} \tag{6}$$

In Table 5 Panel B we estimate Eq. 6 using logged *Bond trading volume* as the liquidity measure. In Model 3 we present results using the main effects only, and in Model 4 we include the *MA-Score* × *Log(Bond trading volume)* interaction to test if the *MA-Score* slope significantly varies over levels of *Bond trading volume*. Similar to the interaction between the *MA-Score* and credit rating, the interaction with trading volume is negative and significant at the 5% level, providing cross-sectional evidence that *MA-Score* has a significantly stronger impact on yield spread when *Bond trading volume* is lower. Overall, these results support the contention of *Hypothesis 5* that bond liquidity is a second channel by which managerial ability affects the pricing of corporate bonds.

Table 5 Regressions of seasoned bond yield spread on managerial ability and interactions with default and liquidity measures

	Panel A: credit risk interaction		Panel B: liquidity interaction	
	Model (1)	Model (2)	Model (3)	Model (4)
MA-Score	− 0.0090***	− 0.0358***	− 0.0077***	− 0.1026**
	(0.000)	(0.008)	(0.001)	(0.010)
Bond rating	− 0.0043***	− 0.0043***	− 0.0041***	− 0.0041***
	(0.000)	(0.000)	(0.000)	(0.000)
MA-Score × bond rating		0.0021**		
		(0.037)		
Log(bond trading volume)			− 0.0033***	− 0.0032***
			(0.000)	(0.000)
MA-Score × Log(bond trading volume)				0.0056**
				(0.017)
Duration	− 0.0017***	− 0.0017***	− 0.0015***	− 0.0015***
	(0.000)	(0.000)	(0.000)	(0.000)
Callable	− 0.0017	− 0.0018	− 0.0012	− 0.0014
	(0.131)	(0.113)	(0.192)	(0.148)
Puttable	− 0.0054***	− 0.0052***	− 0.0059***	− 0.0060***
	(0.002)	(0.003)	(0.001)	(0.001)
Subordinate	− 0.0023	− 0.0019	− 0.0035**	− 0.0033**
	(0.156)	(0.213)	(0.031)	(0.034)
Log (issue amount)	− 0.0058***	− 0.0057***	− 0.0028*	− 0.0027*
	(0.000)	(0.000)	(0.078)	(0.083)
Debt ratio	0.0164***	0.0162***	0.0173***	0.0172***
	(0.000)	(0.000)	(0.000)	(0.000)
EBIT/assets	− 0.0534***	− 0.0504***	− 0.0554***	− 0.0548***
	(0.000)	(0.000)	(0.000)	(0.000)
Std. (EBIT/assets)	0.0480***	0.0478***	0.0440***	0.0437***
	(0.000)	(0.000)	(0.000)	(0.000)
Capital expenditure	− 0.0076	− 0.0077	− 0.0073	− 0.0073
	(0.301)	(0.274)	(0.303)	(0.283)
Firm size	0.0008	0.0010	0.0009	0.0009
	(0.231)	(0.164)	(0.201)	(0.216)
Sales growth	− 0.0002	0.0008	− 0.0001	− 0.0001
	(0.972)	(0.880)	(0.977)	(0.975)
Equity beta	0.0035**	0.0034**	0.0036**	0.0035**
	(0.027)	(0.032)	(0.019)	(0.023)
Prior stock return	− 0.0134***	− 0.0133***	− 0.0134***	− 0.0134***
	(0.000)	(0.000)	(0.000)	(0.000)
Aaa–Baa default spread	0.0167***	0.0166***	0.0168***	0.0167***
	(0.000)	(0.000)	(0.000)	(0.000)
Fama–French 49 fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
F-statistic	151.46	154.69	150.54	149.21
R-square	0.44	0.44	0.45	0.45
No. obs.	32,089	32,089	32,087	32,087

Table 5 (continued)

Table 5 presents the sensitivity of corporate bond yield spreads to managerial ability conditional on the proximity to default. Appendix 1 provides the variable descriptions and construction details. Coefficient *p*-values based on two-way clustered standard errors are in parentheses

***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively

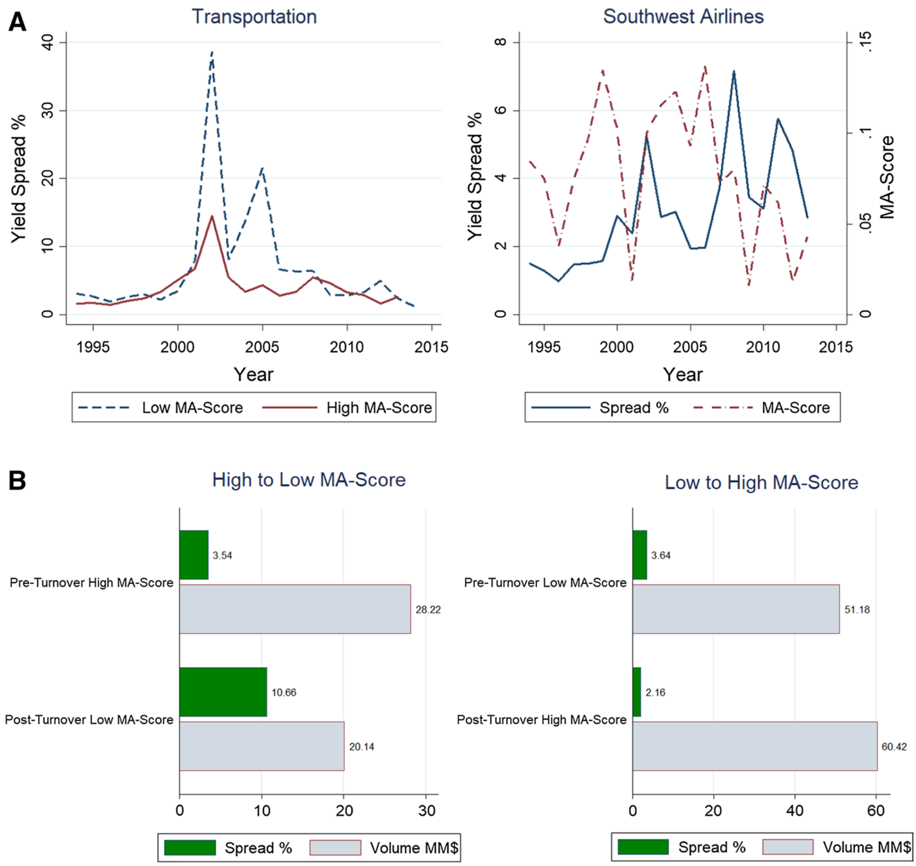

Fig. 1 Effect of *MA-Score* on yield spreads and trading volume. **a** Panel A: Bond yield spreads and trading volume over time. **b** Panel B: Impact of CEO turnover on bond yield spreads and trading volume. In Panel A, the left figure shows average (mean) yearly yield spreads for transportation sector issuers with low (bottom quartile) and high (top quartile) *MA-Score*. The right figure illustrates yield spreads and *MA-Score* over time using Southwest Airlines Co as an example. In Panel B, the left (right) figure demonstrates the impact from a change from a high- (low-) to low- (high-) ability CEO on mean yield spread and trading volume. There are 3 top-to-bottom quartile *MA-Score* CEO turnovers representing 65 yield spread observations in our sample, and also 3 bottom-to-top quartile *MA-Score* CEO turnovers representing 10 yield spread observations

We graphically illustrate the impact of changes in managerial ability in Fig. 1. Following our hypotheses and empirical results, we expect to find that bonds issued by firms with high (top quartile) ability managers have persistently lower yield spread. Further, we expect that the information provision function associated with the *MA-Score* becomes relatively more important during financial crises as investors increase their demand for firm-specific information (e.g. Ahnert and Kakhbod 2017). To investigate this premise, we sort the bond sample used in Tables 4 and 5 into yearly *MA-Score* quartiles and calculate mean yield spread for each year. Figure 1 Panel A reports the results of this analysis using the transportation sector as an example. Using the full sample, mean yield spread for high (low) *MA-Score* issuers is generally lower (higher). However, the relation becomes pronounced in periods where aggregate credit conditions worsen, particularly in 2001–2002. In Fig. 1 Panel B we illustrate the relation between the *MA-Score* and the average yield spread for a specific company (Southwest Airlines Co). Over the years 1994–2013, Panel B generally demonstrates the intuition that higher (lower) *MA-Score* results in lower (higher) risk to bond investors.

In Fig. 1 Panel B we illustrate the impact of large changes in *MA-Score* associated with CEO turnover on the cost of debt and trading volume. Specifically, we examine CEO changes where the *MA-Score* increases from the lowest (prior CEO) to the highest (new CEO) quartiles. We also construct a sample of CEO changes where the *MA-Score* decreases from the top to the bottom quartiles. We illustrate mean yield spreads and bond trading volume associated with these turnover events. Consistent with our cross-sectional results, CEO turnover that results in significant increases (decreases) in the *MA-Score* are associated with large decreases (increases) in yield spread and trading volume.[5]

4.4 Tests of robustness

4.4.1 Alternative measures of covenant structure, bond maturity, and collateralization

In Table 6 Panel A we present *MA-Score* coefficient estimates corresponding to *Hypotheses 1–3* using alternative measures of bond covenant structure, maturity, and seniority. In Panel A1, we repeat the analysis of Table 2 using FISD covenant information merged to the SDC sample at the bond level which results in a more restrictive, but precise, bond-level merge. Based on a sample of 2866 bond observations, the *MA-Score* coefficient estimates in Models 1–4 are consistent with our findings reported in Table 2, where *MA-Score* is significantly negatively associated with *Capital covenants*, positively associated with *Performance covenants*, and negatively associated with the ratio of capital- to performance covenants. These results provide additional support for *Hypothesis 2*'s predictions relating to managerial quality and bond covenant structure. In Panel A2 we present alternative bond- and firm-level measures of bond maturity. We use the modified duration of newly issued

[5] We also examine if the *MA-Score* matters more in industries that are more competitive and where managers have less control over pricing power. We segment the sample into more and less competitive industries using the standard Herfindahl–Hirschman Index and, alternatively, the historical fitted SIC-based HHI measure provided by Gerard Hoberg and Gordon Phillips and used by Hoberg and Phillips (2010). Hoberg and Phillips (2010) use the fitted HHI index to assess competitive and concentrated industries and is the predicted level of industry concentration based on three-digit SIC codes using data from the Department of Commerce manufacturing HHI data, Bureau of Labor Statistics employee data and Compustat sales data. Finally, we use the TNIC HHI provided by the same authors. The TNIC HHI is based on 10-K product descriptions and uses time-varying measures of product similarity to measure how firms differ from their competitors. In untabulated results, the negative *MA-Score* coefficient intensifies in relatively competitive environments using these three measures and has a greater cross-sectional effect on the yield spreads of information sensitive debt. We thank an anonymous reviewer for pointing out this possibility.

Table 6 Cross-sectional robustness tests

	Panel A1: covenant structure				Panel A2: maturity and collateralization			
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)
	Covenant index	Capital covenants	Performance covenants	Covenant structure	Duration	ST3	LT dummy	Senior secured dummy
Panel A: alternative measures of covenant structure, maturity, and collateralization								
MA-Score	0.0673	− 0.1680***	0.2354**	− 0.2781***	0.8352**	− 0.0857***	0.4287***	− 1.4805***
	(0.653)	(0.001)	(0.040)	(0.000)	(0.027)	(0.004)	(0.002)	(0.005)
Additional control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fama–French 49 fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic (Chi square)	38.52	142.80	1.85	35.72	14.99	12.65	445.55	451.96
R-square (pseudo *R*-square)	0.52	0.29	0.69	0.66	0.13	0.19	0.06	0.40
No. Obs.	2866	2866	2866	2866	5644	5592	5670	4755

	Panel B1: credit risk interactions		Panel B2: liquidity interactions	
	Model (1)	Model (2)	Model (3)	Model (4)
Panel B: interactions between MA-Score and alternative measures of risk and liquidity				
MA-Score	− 0.0034	− 0.0272***	− 0.1019***	− 0.0063**
	(0.100)	(0.000)	(0.001)	(0.021)
Prob(default)	0.0009***			
	(0.000)			
MA-Score × prob(default)	− 0.0006**			
	(0.035)			
Z-Score		− 0.0005		
		(0.392)		
MA-Score × Z-Score		0.0070***		
		(0.000)		

Table 6 (continued)

	Panel B1: credit risk interactions		Panel B2: liquidity interactions	
	Model (1)	Model (2)	Model (3)	Model (4)
− Log(Amihud)			− 0.0029***	
			(0.000)	
MA-Score × − Log(Amihud)			0.0086***	
			(0.004)	
Log(bond age)				0.0028***
				(0.000)
MA-Score × Log(bond age)				− 0.0034**
				(0.021)
Additional control variables	Yes	Yes	Yes	Yes
Fama–French 49 fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
F-statistic	172.97	127.02	145.00	136.93
R-square	0.47	0.39	0.45	0.44
No. Obs.	30,514	28,659	29,300	30,087

Table 6 presents tests of robustness for the results presented in Table 5 using alternative measures of default and liquidity risk. Appendix 1 provides the variable descriptions and construction details. Coefficient *p*-values based on two-way clustered standard errors are in parentheses

. ***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively bonds (Model 5), and the proportion of bonds with maturities less than 3 years divided by all long-term debt (Model 6). In Model 7 we use a binary variable for bonds with maturities greater than 10 years (*LT Dummy*) to mitigate potential biases related to non-normality in the distribution of *Time to maturity*. The *MA-score* coefficient estimates in Models 5–7 are in line with the primary result reported in Table 3. Finally, in Model 8 we reexamine *Hypothesis 2* by re-defining the explanatory variable as the proportion of secured debt out of all outstanding debt issues by a given firm in a given year using bond issue information provided by Mergent. Because the explanatory variable is a proportion that varies between 0 and 1, we estimate Model 8 using a fractional generalized linear model.[6] Consistent with Table 3 Model 2, the *MA-Score* estimate is negative and significant at the 1% level. Collectively, these results support the predictions of *Hypotheses 2–3* that higher managerial quality encourages longer-term bond issuance and less collateralization.

4.4.2 Alternative measures of default risk and liquidity

In Table 6 Panel B1, we assess cross-sectional variation in the impact of *MA-Score* on yield spreads using alternative measures of default risk including *Prob(default)* and *Z-score*. Similar to Vassalou and Xing (2004) and Bharath and Shumway (2008), the distance to financial distress is based on the proposition that shareholders hold a call option on the firm value and a strike price is the value of the firm's debt. The probability that this option is going to be out-of-the-money is the probability of default. To calculate this probability, we first subtract the face value of debt from the estimated firm market value. We then divide this difference by an estimate of the scaled volatility of the firm. Finally, we substitute the resulting distance to default measure a cumulative density function to estimate the probability that the value of the firm is less than the value of its debt obligations. The distance to default model allows estimating the probability of default for each firm in the sample. As we demonstrate in Model 1, the interaction between the *MA-Score* and *Prob(Default)* is negative and significant at the 5% level providing further evidence that *MA-Score* has a varying effect over levels of the proximity to default. Alternatively, *Z-score* is a financial ratio-based measure of proximity to bankruptcy and calculated according to the formulation described by Altman (1968). As illustrated by Model 2, the *MA-Score* interaction with *Z-score* is significant at the 1% level.

In Table 6 Panel B2, we examine two alternative measures of bond liquidity. First, the Amihud (2002) measure is estimated as the negative of $\frac{1}{D}\sum_{d=1}^{D}\frac{|R_{itd}|}{V_{itd}}$, where D is the number of trading days in year t, R_{itd} is the return on bond i on day d of year t, and V_{itd} represents the dollar volume on day d of year t. The bond trading volume measure is the dollar transaction volume in year t (e.g. Brennan, Chordia and Subrahmanyam 1998; Chordia et al. 2001). Following Chordia et al. (2014), we take the natural logarithm of the Amihud measure. In Model 3, greater liquidity as proxied by higher magnitudes of the Amihud measure is negatively associated with yield spread as predicted. Alternatively, we use the logged age of the bond from issuance (*Bond age*) as a proxy for trading liquidity. Greater *Bond age* represents higher liquidity risk since older bonds trade less frequently than younger bonds (e.g. Huang et al. 2015). In Model 4, the *MA-Score* interaction with logged *Bond age* is

[6] We estimate this model with the Stata user-written routine FRACGLM, written by Richard Williams. See Papke and Wooldridge (2008) for more information.

significant at the 5% level providing further evidence of a varying impact of *MA-Score* on yield spread according to liquidity. Taken together, the results of Table 6 Panels A–B provide further support for *Hypotheses 4–5* that the effect of managerial ability on the pricing of corporate debt varies in default and liquidity risks.

4.4.3 Managerial ability and idiosyncratic stock return volatility

As a further test of robustness for the yield spread analysis, we investigate if managerial ability affects idiosyncratic stock return volatility through the default and liquidity risk channels. Prior research shows that stock return volatility is associated with investor uncertainty and information asymmetry. For example, show that greater investor uncertainty is associated with more return volatility in an environment where investors are uncertain about the firm's true profitability (Pástor and Veronesi 2003; Chen 2013). More specifically, Chen et al. (2012) examine if the information quality underlying managerial discretion on reported earnings is a mechanism that explains trends in idiosyncratic volatility. Chen et al. (2012) find that lower information quality, as measured by the volatility of discretionary accruals and the correlation between pre-managed earnings and discretionary accruals, is directly associated with higher idiosyncratic return volatility. We combine these two streams of research. First, a line of research discussed above documents an association between managerial ability and the quality of accounting information. Second, Chen et al. (2012) show that accounting information quality is associated with idiosyncratic return volatility. Therefore, we expect a pronounced impact of managerial ability on return volatility when the effects of information asymmetry are likely to be more severe, i.e. when default risk is higher and when illiquidity is greater. We estimate the following regression using stock idiosyncratic return volatility as the dependent variable:

$$\begin{aligned} Idiosyncratic\ return\ volatility_{i,t} = {} & \alpha_0 + \alpha_1 MA - Score_{i,t} + \alpha_2 Default(or\ liquidity)measure_{i,t} \\ & + \alpha_3 MA - Score \times Default(or\ liquidity)measure_{i,t} \\ & + \alpha_4 Debt\ ratio_{i,t} + \alpha_5 Firm\ size_{i,t} + \alpha_6 Market \\ & - book\ ratio_{i,t} + \alpha_7 Std.(EBIT/Assets)_{i,t} + \alpha_8 Log(Firm\ age)_{i,t} \\ & + \alpha_9 R\&D\ Expenditure_{i,t} + \alpha_{10} Log(No.\ Estimates)_{i,t} \\ & + \alpha_{11} HHI_{i,t} + Fama - French\ 49\ industry\ fixed\ effects_j \\ & + Year\ fixed\ effects_t + e_{i,t} \end{aligned} \tag{7}$$

Consistent with the results the analyses above, we use three alternative firm-level measures of default including *S&P Quality rating*, *Prob (Default)*, and *Z-score*. We obtain *S&P Quality rating* from Compustat (data item SPCSRC), which measures the issuer's overall creditworthiness apart from its ability to repay individual obligations. We recode letter ratings to numerical equivalents from 1 (D) through 8 (A+). The *Prob(Default)* and *Z-score* measures are as described above. We also employ three alternative measures of stock liquidity. First, the equity Amihud (2002) measure is estimated as the negative of $\frac{1}{D}\sum_{d=1}^{D}\frac{|R_{itd}|}{V_{itd}}$, where D is the number of trading days in year t, R_{itd} is the return on equity i on day d of year t, and V_{itd} represents the equity dollar trading volume on day d of year t. Second, *Logged total equity volume* is end-of-day price multiplied by number of shares traded for each day and cumulated for a year. Finally, *Stock bid ask spread* is the mean of daily bid-ask spread measured over year t.

Table 7 Stock idiosyncratic return volatility regressed on managerial Ability and interactions with default and liquidity measures

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
MA-Score	− 0.0434***	− 0.0068***	− 0.0247***	− 0.0366***	− 0.0743***	− 0.0140***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Firm quality rating	− 0.0055***					
	(0.000)					
MA-Score × firm quality rating	0.0088***					
	(0.000)					
Prob (default)		0.0004***				
		(0.000)				
MA-Score × prob (default)		− 0.0024***				
		(0.000)				
Z-Score			− 0.0004***			
			(0.000)			
MA-Score × Z-Score			0.0014***			
			(0.006)			
− Log (Amihud)				− 0.0014*		
				(0.094)		
MA-Score × − Log (Amihud)				0.0037***		
				(0.000)		
Log (total equity volume)					0.0024**	
					(0.018)	
MA-Score × Log (total equity volume)					0.0039***	
					(0.000)	
Stock bid-ask spread						0.3291***
						(0.000)
MA-Score × stock bid-ask spread						− 0.4294***
						(0.003)

Table 7 (continued)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Log (No. estimates)	− 0.0024***	− 0.0025**	− 0.0023**	− 0.0012	− 0.0048***	− 0.0015*
	(0.009)	(0.021)	(0.016)	(0.278)	(0.000)	(0.088)
Debt ratio	0.0259***	0.0245***	0.0285***	0.0342***	0.0390***	0.0298***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm size	− 0.0057***	− 0.0076***	− 0.0081***	− 0.0069***	− 0.0105***	− 0.0067***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-book ratio	− 0.0007	− 0.0016**	− 0.0005	− 0.0013**	− 0.0025***	− 0.0009
	(0.207)	(0.043)	(0.403)	(0.045)	(0.001)	(0.109)
Std. (EBIT/assets)	0.0434***	0.0554***	0.0461***	0.0462***	0.0441***	0.0456***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (firm age)	− 0.0036***	− 0.0043***	− 0.0046***	− 0.0045***	− 0.0048***	− 0.0046***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&D expenditure	0.0004***	0.0007***	0.0009***	0.0007***	0.0005***	0.0008***
	(0.002)	(0.001)	(0.000)	(0.001)	(0.003)	(0.000)
HHI	0.0056***	0.0036*	0.0050**	0.0050**	0.0041*	0.0042**
	(0.004)	(0.070)	(0.014)	(0.027)	(0.057)	(0.032)
Sales growth	0.0042**	0.0096***	0.0070***	0.0055***	0.0033***	0.0088***
	(0.019)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)
Fama–French 49 fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	285.70	243.27	307.63	252.88	254.19	343.80
R-square	0.47	0.46	0.44	0.42	0.42	0.45
No. Obs.	35,822	31,318	41,519	33,262	33,356	46,167

Table 7 presents coefficient estimates of idiosyncratic stock return volatility regressed on *MA-Score*, interactions between *MA-Score* and measures of default and liquidity risk, and additional control variables. All explanatory variables are lagged one year. Appendix 1 provides the variable descriptions and construction details. Coefficient *p*-values based on two-way clustered standard errors are in parentheses

***, ***, **, and *Correspond to significance at the 1, 5, and 10% level, respectively

In Table 7, we provide regression estimates corresponding to Eq. 7. To capture the effect of *MA-Score* on forward volatility, we lag the explanatory variables 1 year. In Model 1, we estimate Eq. (6) without interactions. Consistent with the intuition that greater ability is associated with higher quality accounting information; *MA-Score* is negatively associated with idiosyncratic volatility. Models 2–7 illustrate that the effect of *MA-Score* on volatility varies over the levels of default and liquidity risks: Models 2–4 show that the interactions between *MA-Score* and the three default risk measures are significant at the 1% level. Likewise, in Models 5–7 the interactions between *MA-Score* and the three alternative liquidity measures are significant the 1% level. Collectively, these results are consistent with the empirical yield spread results supporting *Hypotheses 4–5*: the impact of managerial ability on the information environment intensifies in the level of default risk and illiquidity.

5 Conclusions

We investigate the association between managerial ability and the design and pricing of corporate debt using a new manager-specific measure of ability developed by Demerjian et al. (2012). Following the finding of prior research that managers with greater ability play an important role in reducing informational asymmetry and risk, we hypothesize that higher managerial ability mitigates bond market participants' assessment of information risk. In particular, we surmise that the negative association between ability and information risk should have an impact on structural characteristics of corporate debt that are sensitive to information asymmetries between the firm and outside investors. We also hypothesize that higher ability increases the value of information-sensitive debt by reducing the liquidity and default risk premia demanded by investors.

Consistent with the prediction that the managerial ability measure is a reliable proxy for contractible information, in the initial analysis we document a significant negative (positive) relation between the *MA-Score* and the use of capital (performance) covenants. Consistent with these findings, we find that lower asymmetry associated with managers with greater capability allows firms to issue a relatively higher proportion of long-term debt and a lower proportion of senior secured bond issues. In subsequent analysis, we focus on the default and liquidity risk channels that link managerial ability with the risk premia demanded by bond market participants. Based on the premise that ability has a pronounced impact on bond pricing when debt is information-sensitive, we find that the impact of *MA-score* on yield spread is increasing in default risk and trading illiquidity. In a similar vein, we find the association between ability and idiosyncratic stock return volatility is strongest when default risk is higher and trading liquidity is lower, i.e. when the effects of information risk are likely to be more severe. Overall, these results demonstrate that management characteristics play an important role in the design of new securities and in the subsequent pricing of these securities in the secondary markets.

Acknowledgements We thank Colin T. Campbell Doina Chichernea and participants at the 2016 American Accounting Association NY for valuable comments and suggestions. Any remaining errors or omissions are ours alone.

Appendix 1

See Table 8.

Table 8 Variable definitions

Variable name	Description and source
Panel A1: issue-level variables	
Yield spread	The bond's yield-to-maturity minus the interpolated monthly Treasury bond yield. *Sources*: SDC Platinum (at-issue bond prices), St. Louis Federal Reserve (Treasury Note and Number of years to final maturity
Time to maturity	Fractional number of years between the issue date or transaction date to the maturity date. *Sources*: SDC (at-issue analysis), Mergent FISD (seasoned bond analysis)
LT Dummy	Binary variable equal to one if the time to maturity exceeds 10 years. *Source*: SDC Platinum
Issue amount	Log of the bond's par amount at issue. *Sources*: SDC Platinum (at-issue), Mergent FISD (transaction-level)
Duration	First derivative of the price-yield function, using the at-issue (or seasoned) bond price, time to maturity, and yield to maturity. Source of inputs: SDC (at-issue analysis), Mergent FISD (seasoned bond analysis)
Callable	Binary variable = 1 if the bond is callable (i.e. if Call Protection = 'Non-Call Life'). *Source*: SDC Platinum
Puttable	Binary variable = 1 if the bond is puttable. *Source*: SDC Platinum
Subordinate	Binary variable = 1 if the bond issue is subordinate to other bond issues. *Source*: SDC Platinum
High yield	Binary variable equal to one if the Moody's rating is Ba or below. *Source*: SDC Platinum
Proportion senior secured	Proportion of debt classified as senior secured divided by all outstanding debt issues in a given year. *Source:* Mergent FISD
Capital covenant index	Capital = INVESTMENTS + INVESTMENTS_UNRESTRICTED_SUBS + SENIOR_DEBT_ISSUANCE + LEVERAGE_TEST + LEVERAGE_TEST_SUB + STOCK_ISSUANCE_ISSUER + STOCK_ISSUANCE + PREFERRED_STOCK_ISSUANCE + STOCK_TRANSFER_SALE_DISP. *Source*: Mergent FISD
Performance covenant index	Performance = FIXED_CHARGE_COVERAGE + FIXED_CHARGE_COVERAGE_SUB + NET_EARNINGS_TEST_ISSUANCE. *Source*: Mergent FISD
Covenant index	Sum of capital and performance covenants. *Source*: Mergent FISD
ST3	Sum of debt maturing in 1–3 years (DD1–DD3) divided by total liabilities (sum of DLC and DLTT). *Source:* Compustat
Panel A2: Default and liquidity measures	
Bond rating	Moody's bond letter rating converted to numerical equivalents, ranging from 1 to 21. *Source*: Mergent FISD
Prob(default)	Measure of default risk following Bharath and Shumway (2008), *Source*: Compustat/CRSP
Z-Score	Measure of default risk following Altman (1968). *Source*: Compustat
Bond age	The number of fractional years between the issue date and the transaction date. *Source*: Mergent FISD

Table 8 (continued)

Variable name	Description and source
Amihud measure	Measure of bond liquidity following Chordia et al. (2014). *Source*: Mergent FISD
Volume (per year in $Mil)	Logged annual bond trading volume. *Source*: Mergent FISD
Panel B: issuer characteristics	
Panel B1: managerial ability and information asymmetry measures	
MA-Score	Measure of managerial ability developed by Demerjian et al. (2012). *Source*: http://faculty.washington.edu/smcvay/abilitydata.html
Idiosyncratic stock volatility	Standard deviation of the residual from calendar year regressions of weekly stock return on the weekly value-weighted CRSP market index and value-weighted Fama–French 49 industry returns. *Source*: CRSP
Stock bid-ask spread	Calendar year average closing stock bid-ask spread over the 253 days prior to the fiscal year end date. *Source:* CRSP
Probability of informed trading	Obtained from http://scholar.rhsmith.umd.edu/sbrown/pin-data
Panel B2: other issuer-level control variables	
Debt ratio	Sum of interest bearing debt (DLC plus DLTT) divided by total assets (AT). *Source:* Compustat
Firm quality rating	S&P Quality rating (SPCSRC). *Source: Compustat*
EBIT/assets	Earnings before interest and tax (EBIT) divided by total assets (AT). *Source: Compustat*
Std. (EBIT/assets)	Standard deviation of *EBIT/Assets* for the prior 5 years. *Source:* Compustat
Capital expenditure	Capital expenditures (CAPX) divided by book total assets (AT). *Source*: Compustat
Firm size	Logged total assets (AT). *Source*: Compustat
Sales growth	Five-year growth in sales (SALE). *Source*: Compustat
Stock beta	The coefficient on the CRSP value-weighted market index, based on a three-factor market model estimated over the (− 200, − 1) period prior to the bond transaction date. *Source*: CRSP
Lagged stock return	Cumulative daily stock return measured over the (− 200, − 1) period prior to the bond transaction date. *Source*: CRSP
Market-book ratio	Total liabilities plus market capitalization of equity divided by total assets (AT-CEQ + (PRCCF × CSHO)/AT). *Source:* Compustat
Asset maturity	(Gross property, plant, and equipment (PPEGT)/total assets (AT)) × (gross property, plant, and equipment (PPEGT)/depreciation expense (DP)) + (current assets (ACT)/total assets (AT)) × (current assets (ACT)/cost of goods sold (COGS)) *Source*: Compustat
Loss Dummy	Binary variable equal to one if NI is negative. *Source*: Compustat
Advertising expenditure	Advertisement expense (XAD) divided by total revenue (REVT). *Source*: Compustat
R&D expenditure	R&D expense (XRD) divided by net sales (SALE). *Source*: Compustat

Table 8 (continued)

Variable name	Description and source
Asset tangibility	Net property plants and equipment measured as PPENT/AT Compustat XRD/REVT
Stock volatility	Annualized equity volatility. *Source*: CRSP
Panel B3: additional control variables	
Slope	Difference between the 10-year Treasury Note and 3-month Treasury Bill rates at the end of the month of the issue date. Source: FRED© Economic Data, St. Louis Fed
Std. Slope	Standard deviation of monthly *Slope*, measured over the prior 6 months. Source: FRED© Economic Data, St. Louis Fed
Aaa–Baa default spread	Difference between the Baa and Aaa rates based on the month of the transaction. Source: FRED© Economic Data, St. Louis Fed

Appendix 2

See Table 9.

Table 9 Descriptive statistics of the at-issue corporate bond sample

	No. issues	Proportion of sample
Panel A: bond issue characteristics		
Embedded options		
Callable	2810	0.4956
Puttable	85	0.0148
Security and seniority		
Senior secured	124	0.0219
Senior unsecured	1664	0.2935
Senior subordinate	401	0.0707
Subordinate	23	0.0041
Junior	1	0.0002
Unclassified	3547	0.6256
Bond (Moody's) rating:		
Aaa	28	0.0049
Aa1–Aa3	454	0.0801
A1–A3	1574	0.2776
Baa1–Baa3	1796	0.3168
Ba1–Ba3	617	0.1088
B1–B3	1074	0.1894
Caa1–Ca	127	0.0224
High yield	1818	0.3206

Table 9 (continued)

	Mean	St Dev.	10%	25%	Median	75%	90%
Panel B: Pooled sample bond characteristics							
Yield spread	0.0225	2.0156	0.4862	0.8196	1.5758	3.2198	5.1952
Time to maturity (years)	11.2348	7.9691	5.0055	6.9808	10.0109	10.0767	30.0219
LT Dummy	0.5402	0.4984	0	0	1	1	1
Duration	7.1717	3.0551	4.1670	5.1131	5.1131	8.0932	12.2255
Proceeds amount ($Mil.)	921	2002	100	200	400	1000	2250
Covenant structure							
Capital index	0.3478	0.7682	0	0	0	0	1
Performance index	0.4747	0.8456	0	0	0	0	2
Covenant index	0.8225	1.1608	0	0	0	2	2
No. Obs.	5670						

	Mean	Std. Dev.	10%	25%	Median	75%	90%
Panel C: Pooled issuer characteristics							
MA-Score	0.0041	0.1377	− 0.1563	− 0.0732	− 0.0002	0.0720	0.1820
Proportion senior secured	0.0148	0.1094	0	0	0	0	0
Total assets ($Mil)	13,782	27,850	696	1706	4646	13,152	33,567
Market-book ratio	1.7263	0.7774	1.0529	1.2128	1.4962	1.9937	2.6987
Loss dummy	0.1454	0.3526	0	0	0	0	1.0000
Advertising expenditure	0.0139	0.0277	0	0	0	0.0154	0.0464
R&D expenditure	0.0186	0.0422	0	0	0	0.0176	0.0547
Asset tangibility	0.3808	0.2600	0.0751	0.1634	0.3245	0.5844	0.8006
Z-score	2.8169	1.7175	1.0087	1.6027	2.5711	3.7314	5.0110
Debt ratio	0.3619	0.1702	0.1678	0.2452	0.3376	0.4470	0.6017
ST3	0.1632	0.1650	0	0.0206	0.1230	0.2496	0.3999
One-year stock return	0.1933	0.3917	− 0.2260	− 0.0194	0.1639	0.3620	0.6060
Stock volatility	0.3328	0.2028	0.1502	0.2030	0.2876	0.4032	0.5609
EBIT/assets	0.0971	0.0698	0.0298	0.0607	0.0942	0.1320	0.1755
Std. (EBIT/assets)	0.0319	0.0372	0.0069	0.0119	0.0207	0.0363	0.0663
Asset maturity	4.8964	5.2010	0.7053	1.3872	2.9005	6.5692	12.0022
Additional determinants							
Yield curve slope	1.5400	1.1554	0.1000	0.5200	1.5000	2.5100	3.2400
Std. Slope	0.1968	0.1195	0.0792	0.1022	0.1551	0.2697	0.3826
Default spread	0.9600	0.4472	0.6000	0.6800	0.8600	1.0500	1.3500
No. Obs.	3296						

Appendix 2 provides the summary statistics for 5670 at-issue bond observations with a complete set of control variables, based on 1195 unique firm issuers distributed over 3296 firm-years. Appendix 1 provides the variable descriptions

Appendix 3

See Table 10.

Table 10 Descriptive statistics of the transaction-level corporate bond sample

	No. Issues	Proportion of Sample
Panel A: Bond issue characteristics		
Embedded options		
Callable	5495	0.8045
Puttable	100	0.0135
Security and seniority		
Senior secured	821	0.1111
Senior unsecured	6217	0.8413
Senior subordinate	221	0.0299
Subordinate	8	0.0011
Junior secured	7	0.0009
Non-classified	116	0.0166
Bond (Moody's) rating:		
Aaa	64	0.0087
Aa1–Aa3	387	0.0524
A1–A3	1744	0.2360
Baa1–Baa3	2402	0.3250
Ba1–Ba3	1065	0.1441
B1–B3	1511	0.2045
Caa1–Ca	217	0.0294
High yield	2793	0.3779

	Mean	St Dev.	10%	25%	Median	75%	90%
Panel B: Pooled sample bond characteristics							
Yield to maturity	0.0722	0.0680	0.0308	0.0494	0.0655	0.0817	0.1023
Yield spread	0.0353	0.0680	0.0085	0.0126	0.0209	0.0396	0.0652
Time to maturity (years)	10.7848	11.5563	2.1315	4.2794	7.3233	11.3479	26.3671
Duration	6.1171	3.6693	1.9046	3.5506	5.4498	7.8999	11.7840
Proceeds amount ($Mil.)	415	399	125	200	300	500	850
Bond age	4.1490	4.1039	0.1918	1.1123	3.0466	5.9014	9.4356
Bond issues per issuer	5.8791	7.5989	1	2	3	7	14
No. Obs.	32,089						

	Mean	SD	10%	25%	Median	75%	90%
Panel C: pooled issuer characteristics							
MA-Score	0.0032	0.1324	− 0.1467	− 0.0753	− 0.0051	0.0704	0.1712
Default measures							
Prob(default)	4.5478	15.6407	0.0000	0.0000	0.0000	0.0299	8.1295
Z-Score	2.8736	1.6643	1.1001	1.7537	2.5881	3.6736	4.9784
Liquidity measures							
Log (Amihud)	− 10.4655	1.4743	− 8.6318	− 9.7001	− 10.6305	− 11.3826	− 12.0485
Volume (per year in $Mil)	27.1563	31.6565	1.3114	5.1501	16.0769	37.1947	69.8017
Other firm-level control variables							
Debt ratio	0.3449	0.1779	0.1483	0.2199	0.3139	0.4377	0.5784

Table 10 (continued)

	Mean	SD	10%	25%	Median	75%	90%
EBIT/assets	0.0924	0.0684	0.0236	0.0563	0.0904	0.1290	0.1733
Std. (EBIT/assets)	0.0340	0.0334	0.0085	0.0138	0.0236	0.0409	0.0692
Capital expenditure	0.0641	0.0651	0.0137	0.0244	0.0433	0.0770	0.1383
Total assets ($Mil)	11,200	24,663	700	1485	3654	10,311	26,689
Sales growth	0.0817	0.1285	− 0.0309	0.0123	0.0551	0.1193	0.2252
Stock beta	1.0871	0.4660	0.5373	0.7769	1.0453	1.3578	1.6952
Prior stock return	0.1173	0.3839	− 0.3153	− 0.0708	0.1240	0.3039	0.5275
No. Obs.	9147						

Appendix 3 provides summary statistics for 32,089 at-issue bond observations in the primary sample, based on 7390 bonds issued by 1257 unique firm issuers distributed over 9147 firm-years. Appendix 1 provides the variable descriptions

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