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Earnings management uncertainty, implicit guarantees, and the corporate bond yield spread: Evidence from China

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Abstract

We examine the impact of earnings management uncertainty (EMU) on bond yield spreads in China. In the process, we decompose the bond yield spread into liquidity and default yield spreads. The findings suggest that EMU primarily drives the default yield spread of a corporate bond and that its impact on the liquidity yield spread is minimal. Our results are robust to alternative metrics of default and liquidity yield spreads and to a battery of robustness checks. In addition, we find that the implicit government guarantees from both the Chinese central and local governments partially offset the impact of EMU on overall bond yield and default yield spreads.

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1. Introduction

Previous studies have documented that a firm's idiosyncratic risk significantly impacts on its default risk (Campbell & Takser, 2003; Chen et al., 2015; Duffie & Lando, 2001). Specifically, Duffie and Lando (2001) show that, not only does, as a major source of idiosyncratic risk, the incomplete accounting information level play an important role in determining corporate default risk, but so do its variations. Chen et al. (2015) further document that the variations of incomplete accounting information, as proxied by real earnings management volatility (EMU), is more important than the level of incomplete accounting information, proxied by real

earnings management level in determining corporate bond yield spread.

While the findings of Duffie and Lando (2001) and Chen et al. (2015) are insightful, we are still unclear on two aspects of some related issues. First, there are two major components of bond yield spread: liquidity and default risk spreads. We do not know if the EMU contributes more to the liquidity risk or the default risk components of the yield spread in Duffie and Lando (2001) and Chen et al. (2015). These authors interpret the yield spread as a single element without disentangling the liquidity and default risk components of the yield spread. Dick-Nielsen et al. (2012), Black et al. (2016), and Clark and Baccar (2018) document that liquidity risk is an important determinant of the yield spread of a corporate bond. Therefore, it is useful to distinguish the impact of the EMU on both the liquidity risk and default risk components of the yield spread and determine which channel is more important for determining the yield spread.

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Our decomposition of bond yield spread into the liquidity and default risk components has important practical implications, especially in the context of China. Compared to developed economies, the Chinese corporate bond market is still in its infancy stage and underdeveloped in various dimensions. In particular, the Chinese corporate bond market is much more illiquid than those of developed markets, such as U.S. corporate bond market. For instance, [Chen and Jiang \(2020\)](#) find that the magnitude of illiquidity of the Chinese corporate bond market is far larger than that of U.S. In addition, while liquidity risk is also well priced, the authors document that default risk of Chinese corporate bonds explains approximately 78% of the average corporate bond spread over the period 2009–2016. Therefore, disentangling the bond pricing factors, like EMU, in terms of liquidity and default spreads, provides important policy implications for Chinese policy makers and corporate managers in two aspects. First, if Chinese regulators like to lower firms' borrowing costs in the bond market to enhance economic growth, sweeping away the market frictions to improve liquidity would not be sufficient if the default premium is a major contributing factor of the corporate bond yield spread. Second, for corporate managers, to lower borrowing costs, they need to make more effort to reduce default risk rather than those being favorable to improve bond liquidity to bond investors when incomplete accounting information, like EMU, contributes more to default risk than liquidity risk. Collectively, it is paramount important for both policy makers and corporate managers to distinguish the pricing implication of bond pricing factors so that they can take effective measures to lower the borrowing costs in bond markets, which is especially relevant in emerging markets, like China, featured with nascent and underdeveloped bond markets.

Moreover, corporate bond market has grown rapidly in recent years, which has been one major channel of corporate direct financing in China. Data from the WIND database show that the issue size of corporate bonds has increased from 227.6 billion (RMB) in 2007 to 3000 billion (RMB) in 2016. The yearly contribution of corporate bond financing to the increment of yearly aggregate financing to the real economy in China has soared from 3.8% (in 2007) to 16.9% (in 2016). The amount of exchange-traded bonds reached 9.0 trillion (RMB) or 10.5% of total outstanding bonds as of 2018. Consequently, there is no doubt that corporate bond financing has become more and more important for Chinese companies. Therefore, our study timely investigating bond financing problems has important management strategy implications for Chinese companies.

Second, in emerging markets, it is common for a government to use subsidies or preferential tax policies to guide the economic activities as part of a broad economic policy. In the context of corporate bonds, what really makes China different from other countries is the prevalent perception of implicit government guarantees in China's financial system. Unlike in most other bond markets, where lenders and borrowers expect

certain risks of potential defaults and bankruptcies, investors in China's bond market incline to believe that the liabilities of certain firms can be taken care of or bailed out by the parent companies or government agencies when needed. Investors even believe that the Chinese government can pay for firms if it sets its mind to it ([Zhu et al., 2019](#)). Moreover, local political leaders in China have strong incentives to help firms in their jurisdictions raise capital to promote local economic growth. Good local economic performance can enhance the careers of political leaders ([Li & Zhou, 2005](#)). Therefore, investors also expect implicit guarantees for those local government-preferred firms. Moreover, implicit guarantees are common for bonds issued by large and/or state-owned firms. For instance, [Klein and Weill \(2018\)](#) document that, as an implicit guarantee, state-ownership of a firm can boost the value of a Chinese bond. Implicit guarantees also apply to some private firms, especially those deemed “too big to fail” for the local economy and labor markets. Consequently, the pricing of a private firm's bonds sometimes also reflects to what extent investors expect the firm related government agencies would be willing to bail the firm out in the event of distress ([Zhu et al., 2019](#)). We do not know how such government involvement in the corporate bond market may moderate the impact of the EMU on the yield spread. Consequently, it is imperative to examine how government implicit guarantees contribute to the bond yield spread, especially allowing for bonds as a major source of direct financing for firms.

The objective of this paper is to examine the impact of EMU on corporate bond yield spread in China. Specifically, following [Schwert \(2017\)](#), we decompose the bond yield spread into its liquidity and default risk components and investigate which channel is more important for determining the impact of EMU on yield spread. In addition, we investigate the potential moderating role played by implicit government guarantees from both the central and local government perspectives. Regarding the central government perspective, we consider firms with large size among all firms in our sample as implicitly guaranteed firms. Because of the common practice of local government guarantees in corporate bond issuance in China, we also consider corporate bonds issued by local large firms as having an implicit government guarantee ([Liu et al., 2017](#); [Zhu et al., 2019](#)) and investigate the associated moderating effect.

The Chinese environment offers two interesting elements for our study. First, the Chinese corporate bond market began in 2007. Similar to other emerging markets, the Chinese corporate bond market is more illiquid than mature markets. Hence, the liquidity risk in China may be relevant, and the findings may reflect on similar characteristics in other emerging bond markets. Second, the Chinese government has had an aggressive policy of government involvement in economic activities. Therefore, by incorporating the implicit government guarantees on the impact of the EMU on the corporate yield spread, we provide information on the determination of bond yield spreads in similar emerging markets

that also have heavy government involvement. Overall, given that corporate bonds are a major source of corporate financing, the findings of this study are particularly relevant in determining the cost of debt for firms in emerging markets.

We present four major findings. First, EMU, as proxied by both accrual-based and real earnings management (EM) volatilities, positively impacts on bond yield spread; this finding is economically significant. That is, evidence from China is consistent with the evidence from the US documented by [Chen et al. \(2015\)](#). Hence, in terms of the bond valuation model in [Duffie and Lando \(2001\)](#), China is no different than mature markets. Second, using a principal components analysis method to integrate all liquidity measures, we find that EMU does not have significant effects on the liquidity yield spread. In contrast, we find EMU have positive and economically significant impacts on the default yield spread. Hence, we document that the default risk in the Chinese bond market is a more important component in the corporate bond pricing than the liquidity risk. Third, we report that the implicit guarantees from both central and local governments weaken the impact of EMU on both the bond yield and default yield spreads. We interpret the findings to be consistent with the notion that government guarantees can reduce the probability of default of a corporate bond, and thus, it is less important for a firm's EMU to impact on its bond yield and default risk spreads. Our findings are robust to a set of alternative empirical specifications, alternative EMU measures, using individual liquidity metrics, sub-sample analyses, adopting two-way clustering standard errors, adding more control variables, applying an instrumental variable approach, and employing a change model. Overall, the impact of EMU is more important in contributing to the default yield spread than the liquidity yield spread. Government implicit guarantees matter for the impact of EMU on the yield spread.

Our study makes the following contributions to the research literature. Previous literature has explored several factors that have been priced in bond valuation in the Chinese market. For example, [Huang et al. \(2018\)](#) find that corporate social responsibility negatively impacts on corporate bond yield spreads. [Xu et al. \(2017\)](#) report that accruals quality is negatively associated with bond underpricing, and [Wang et al. \(2019\)](#) document that improvement in financial reporting can ease access to cost of bond financing only for privately controlled firms. Our study adds to this line of research by exploring the bond pricing effect of incomplete accounting information from the perspective of EMU, which is different from the existing works on the bond pricing effect of accounting information quality by emphasizing the pricing effect of EMU on different components of bond yield spreads. Decomposing bond yield spreads into liquidity and default components and disentangling the pricing effect of EMU on each component have important implications for both bond issuers and policy makers. Second, we advance the literature on the impact of incomplete accounting information on bond yield spreads by affirming that such impacts primarily drive bond yield spread via the default risk channel. Thus, we highlight the role of accounting information in conveying the

quality of a firm in the lens of bond yield spread. Third, our work differs from existing works on implicit guarantees, such as [Acharya et al. \(2016\)](#), [Tsesmelidakis et al. \(2015\)](#), [Tsesmelidakis and Schweikhard \(2015\)](#), which mainly focus on the effect of government bailout of U.S. financial institutions during financial crisis. Instead, we examine the role of implicit guarantees from both the central and local governments in bond yield spread for bonds issued by non-financial firms. Hence, our findings on implicit guarantees complement the literature. Fourth, our work also differs from [Liu et al. \(2017\)](#), which focuses on local government financing vehicle debt backed directly by local governments or indirectly by central government. Fifth, our study also differs from [Li et al. \(2020\)](#), which evaluates the guarantee effect as the difference between yield spreads of a non-state owned (non-SOE) bond and an SOE bond sharing similar attributes. We investigate the guarantee effect for both non-SOE bonds and SOE bonds based on firm size and find that both non-SOE bonds and SOE bonds with larger issuer size have lower spreads after controlling for the SOE status. Sixth, we find that in emerging markets, government involvement in the bond market weakens the impact of incomplete accounting information on the bond yield spread. Thus, we show that government intervention in the bond market (guarantees) reduces the corporate bond yield spread. Finally, we complement the “too big to fail” literature that focuses on the role of implicit government guarantees in the spread-to-risk relationship in financial sectors ([Acharya et al., 2016](#)) by exploring such roles in that relationship in real sectors.

2. Theoretical framework and hypothesis development

It is always a challenge for bond investors to assess the quality of an issuer's (firm) assets and the accuracy of its liabilities due to information asymmetry between the firm and its investors. Nonetheless, bond investors make investment decisions by drawing inferences from accounting information disclosures and other publicly available information ([Duffie & Lando, 2001](#)). Hence, the information environment of a firm plays a critical role in the bond investors' assessment. The structural credit models of [Merton \(1974\)](#) and [Duffie and Lando \(2001\)](#) suggest that the EMU drives changes to a firm's asset valuation distribution, which leads to bond price changes. When a firm engages in EM, the firm's information environment is less transparent; bond investors face challenges in assessing the value of the firm's assets. In the context of EMU, if a firm broadly changes its EM practices (i.e., EMU is high), bond investors will change their ex-ante valuation of the firm's asset values accordingly. Therefore, bond investors perceive the bond's high risk and they ask for a high bond yield spread as compensation ([Duffie & Lando, 2001](#)).

We contend that the risk of a corporate bond is primarily driven by default and liquidity risks, as [Schwert \(2017\)](#) did for municipal bonds. In the context of default risk, [Altman \(1968\)](#) demonstrates the use of a default risk model to single out the importance of the default risk in determining bond prices and yield spreads. For liquidity risk, [Black et al. \(2016\)](#) and [Clark](#)

and Baccar (2018) suggest that corporate bonds are much less liquid than government bonds. The challenge (or cost) to convert corporate bonds into cash causes bond investors to ask for additional compensation, resulting in a high bond yield spread.

In addition, Lambert et al. (2007) developed a cash flow-based equity pricing model, in which investors update their beliefs on the prior information on the distribution of the future cash flows of the firm when new accounting information is available. They document that better quality of accounting information (in our context, for example, less EMU) reduces the assessed variance of the firm's cash flows. The rationale is that earnings management might make outside investors' belief of a firm's asset value distributions diverge from the actual ones, which implies that EM may cloud the firm's accounting information.

In our setting, we let V_0 and ω represent the ex ante expected value and ex ante precision of the firm's asset value V_T at the future time T . Assume that V_T follows a normal distribution. Suppose that investors receive Q pieces of independent normally distributed accounting information $z_1, \dots, z_Q$, on the ultimate realization of the firm's asset value, where each piece of information has precision γ . Then investors' posterior distribution for the asset value V_T has a normal distribution with mean

$$E(V_T | z_1, \dots, z_Q) = \frac{\omega}{(\omega + Q\gamma)} V_0 + \frac{\gamma}{(\omega + Q\gamma)} \sum_{q=1}^Q z_q,$$

and precision $\omega + Q\gamma$. Then EMU might impact on the precision of the accounting information disclosed by the firm, γ . Therefore, EMU may change the precision as well as the expected value of the asset even if the real distribution of the asset value does not change. What is important here is the change in the precision of the accounting information. Higher EMU means lower precision, or lower value of γ , which in turn negatively impacts on the posterior precision. On the other hand, structural models (e.g., Merton, 1974) show that the variance (inverse of precision) of the asset value positively affects the value of equity and thus negatively affects the value of debt. Combining these, higher EMU implies higher volatility of the asset value, and thus lower value of the debt, which in turn leads to a wider bond yield spread. However, previous theories do not provide a clear judgement if EMU impacts differently on the different components of yield spreads. Without a priori information, it is important to seek answers to questions as to whether EMU equally impacts on default and liquidity yield spreads. Consequently, our first testable hypothesis spawns two versions:

H1A. When a firm has a high EMU, the default yield spread is larger.

H1B. When a firm has a high EMU, the liquidity yield spread is larger.

A strand of literature suggests that there are implicit government guarantees against defaults due to a government's "too-big-to-fail" (TBTF) policy (Acharya et al., 2016). This strand of literature (Acharya et al., 2016; Tsesmelidakis et al., 2015; Tsesmelidakis & Schweikhard, 2015) predominantly focuses on the effects of implicit guarantees in financial sector, while studies on the effects of implicit guarantee in real sector are quite limited. Although Jin et al. (2019) find that the reduction of implicit guarantee alleviates SOEs' soft budget constraint problem and curbs managers' overinvestment behavior, they just regard SOEs as implicitly guaranteed firms by central or local governments. They also did not explore the pricing effects of implicit guarantees. In emerging markets, it is common for government to guarantee a firm's bond issuance (Klein & Weill, 2018), which is particularly the case if the firm is large. In the eyes of local political leaders, large firms can boost the local economy, employment, and tax revenues. According to the TBTF doctrine, we expect local governments to provide implicit guarantees for corporate bonds issued by large firms (Zhu et al., 2019). Hence, we consider two measures of implicit guarantees. One is the absolute firm size to capture the implicit guarantees from the central government perspective, following the TBTF literature. The other, to capture the effects of implicit guarantees from local government perspective, is the firm size relative to its peer firms headquartered in the same province. We argue that, with an implicit government guarantee, a firm is less likely to default. Hence, with all else being the same, investors are willing to accept a small default risk premium, which translates into a smaller default yield spread.

As for liquidity yield spread, the impact of an implicit government guarantee is less direct. On the one hand, the bonds issued by firms with implicit guarantees might be more liquid due to the expectation of implicit guarantees that make people feel such bonds safer and so being easily traded. On the other hand, such bonds also might be less liquid, because investors might hold those bonds with a relatively long investment horizon allowing for the safety from implicit guarantees. Put differently, we cannot have a clear judgement on the impacts of implicit guarantees on the effects of EMU on bonds' liquidity premium, ex ante. Thus, our second testable hypothesis takes on the following forms:

H2A. Conditional on the EMU, the default yield spread is smaller for corporate bonds issued by firms with implicit government guarantees.

H2B. Conditional on the EMU, the liquidity yield spread is smaller for corporate bonds issued by firms with implicit government guarantees.

H2C. Conditional on the EMU, the liquidity yield spread is no relation to implicit government guarantees.

3. Data and methods

3.1. Data

We include all the corporate bonds with fixed coupons issued by public firms in the Shenzhen and Shanghai Exchanges in China. We obtain daily bond data, including the opening price, the closing price, time to maturity, coupon rate, coupon payment frequency, and issue size from the WIND information Co. Ltd. We also obtain Chinese treasury bond information from WIND. Accounting and corporate financial data are obtained from the China Stock Market & Accounting Research Database (CSMAR). We winsorize all continuous variables at the 99% and 1% levels.

Our data filtering procedure is as follows. We delete: (1) bonds issued by financial companies; (2) bonds with time to maturity less than one month; and (3) bonds with incomplete information. After this procedure, we have 870 bond-year observations (from 427 bonds) during the period 2009–2016.¹ When constructing liquidity metrics, due to data unavailability to some individual liquidity measures, we lost 274 bond-year observations. In our final sample, there are 596 bond-year observations (from 233 bonds) from January 2009 to December 2016.

Panel A of Table 1 presents the sample distribution by credit rating and year. Clearly, most bonds have good credit quality at “AA” or above ratings. This pattern comports with the *Corporate Bond Issuance Rules* published by the China Securities Regulatory Commission in 2007. Notably, the rules stipulate that only corporate bonds rated above investment grade can be publicly issued. Therefore, in China, corporate bonds are generally issued by financially secure firms. Panel A also shows that the number of observations increases over years, which is consistent with the fact that the China's corporate bond market is less fully-fledged, and the first corporate bond issued by the Chinese listed firm was floated in the second half of 2007.

3.2. Methods

3.2.1. Incomplete accounting information

We follow Chen et al. (2015) in using EM volatility to capture the impact of the uncertainty of incomplete accounting information. In addition to the EMU derived from the real EM in Chen et al. (2015), we also use the accrual-based EM for robustness.

For the accrual-based EM, we follow Kothari et al. (2005) in using Eq. (1) below to model normal total accruals (TA) as a function of total assets ($ASSET$), change in revenue ($\Delta SALES$), change of accounts receivable (ΔAR), property, plant, and equipment (PPE), and return on assets (ROA) by industry and year.

¹ We aggregate daily bond data to yearly bond data before conducting empirical analysis.

Table 1

Distribution of credit ratings and descriptive statistics.

Panel A: Distribution of credit ratings							
Year	AAA	AA+	AA	AA-	A	CC	Total
2009	12	6	2	1	0	0	21
2010	12	11	5	1	0	0	29
2011	16	14	8	1	0	0	39
2012	30	22	15	3	1	1	72
2013	36	19	17	3	1	1	77
2014	42	20	21	3	1	1	88
2015	40	25	24	2	1	0	92
2016	70	48	54	5	1	0	178
Total	258	165	146	19	5	3	596
Panel B: Descriptive statistics							
Variables	Mean	Std. Dev.	P25	Median	P75	N	
<i>YS (in bps)</i>	200.675	120.138	127.808	185.898	252.100	596	
<i>LS (in bps)</i>	38.779	40.500	13.732	31.808	59.914	596	
<i>DS (in bps)</i>	161.896	126.689	79.254	158.220	225.739	596	
<i>DA</i>	0.002	0.062	−0.032	−0.004	0.027	596	
<i>DA_EBIT</i>	0.003	0.068	−0.035	−0.005	0.029	596	
<i>R_PROD</i>	0.294	1.363	−0.617	−0.168	0.778	596	
<i>R_DISX</i>	−0.053	0.092	−0.086	−0.024	0.004	596	
<i>R_CFO</i>	−0.074	0.350	−0.183	0.029	0.153	596	
<i>RM1</i>	0.418	1.752	−0.699	−0.178	1.005	596	
<i>RM2</i>	0.344	1.415	−0.611	−0.158	0.865	596	
<i>RM3</i>	0.020	0.299	−0.172	−0.051	0.106	596	
<i>R_CFOCV</i>	0.840	1.488	−0.030	0.359	1.358	596	
<i>DAV</i>	0.035	0.057	0.010	0.020	0.038	596	
<i>DAV_EBIT</i>	0.037	0.063	0.011	0.021	0.041	596	
<i>R_PROD</i>	0.389	0.712	0.103	0.206	0.434	596	
<i>R_DISXV</i>	0.011	0.019	0.003	0.006	0.011	596	
<i>R_CFOV</i>	0.161	0.271	0.047	0.089	0.187	596	
<i>RM1_V</i>	0.535	0.967	0.140	0.288	0.585	596	
<i>RM2_V</i>	0.390	0.712	0.104	0.205	0.446	596	
<i>RM3_V</i>	0.169	0.284	0.046	0.095	0.195	596	
<i>R_CFOCV3</i>	0.388	0.548	0.107	0.236	0.494	596	
<i>R_CFOCV3</i>	0.337	0.535	0.085	0.192	0.396	596	
<i>LIG</i>	0.508	0.289	0.271	0.508	0.750	596	
<i>AQ</i>	0.662	12.293	0.064	0.101	0.162	596	
<i>LNAMT</i>	23.123	0.740	22.515	23.026	23.719	596	
<i>LFLL</i>	2.495	1.915	0.951	2.222	3.705	596	
<i>COUPON (%)</i>	5.694	1.034	5.070	5.600	6.350	596	
<i>BAGE</i>	2.459	1.785	1.137	2.107	3.448	596	
<i>RAT</i>	5.079	0.978	4.000	5.000	6.000	596	
<i>ROA (%)</i>	3.420	3.886	1.245	3.023	5.467	596	
<i>LEV</i>	0.599	0.151	0.507	0.620	0.719	596	
<i>LNSIZE</i>	23.987	1.177	23.024	23.929	24.727	596	
<i>GROWTH</i>	0.126	0.364	−0.094	0.080	0.230	596	
<i>SOE</i>	0.733	0.443	0.000	1.000	1.000	596	

This table presents the distribution of corporate bond credit ratings and summary statistics over the sample period 2009–2016. All variables are defined in Table 2.

$$\frac{TA_{i,t}}{ASSET_{i,t-1}} = k_0 + k_1 \frac{1}{ASSET_{i,t-1}} + k_2 \frac{\Delta SALES_{i,t} - \Delta AR_{i,t}}{ASSET_{i,t-1}} + k_3 \frac{PPE_{i,t}}{ASSET_{i,t-1}} + k_4 ROA_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

Then, the discretionary accrual for firm i in year t is the residual from Eq. (1). We use the standard deviation of the absolute value of discretionary accruals over a previous three-year period as our primary measure of the accrual-based EMU, denoted by DAV .

Table 2
Variable definitions.

Variables	Definitions
YS	Yield Spread
LS	Liquidity spread $\Phi_{ijt} = \beta_t^L(\lambda_{ijt} - \lambda_{1p})$ after principal components analysis
DS	Default spread $\gamma_{ijt} = YS_{ijt} - \Phi_{ijt}$
DA	Levels of discretionary accruals, the residuals from equation (5) in Chen et al. (2015)
DA_EBIT	Levels of discretionary accruals, the residuals from equation (6) in Chen et al. (2015)
R_PROD	Real earnings management level from the production cost manipulations
R_DISX	Real earnings management level from the discretionary expenses manipulations
R_CFO	Real earnings management level from the operating cash flow manipulations
R_CFOC	The estimated residual of the following equation for each industry in each year: $R_CFO_{it} = \beta_{0t} + \beta_{1t}R_PROD_{it} + \beta_{2t}R_DISX_{it} + \epsilon_{it}$
RM1	Following Zang (2012) and Cohen and Zarowin (2010), $RM1 = R_PROD - R_CFO - R_DISX$
RM2	Following Zang (2012) and Cohen and Zarowin (2010), $RM2 = R_PROD - R_DISX$
RM3	Following Zang (2012) and Cohen and Zarowin (2010), $RM3 = -R_CFO - R_DISX$
DAV	Volatility of DA over the past 3-year
DAV_EBIT	Volatility of DA_EBIT over the past 3-year
R_CFOV	Volatility of R_CFO over the past 3-year
R_PROD	Volatility of R_PROD over the past 3-year
R_DISXV	Volatility of R_DISXV over the past 3-year
RM1_V	Volatility of RM1 over the past 3-year
RM2_V	Volatility of RM2 over the past 3-year
RM3_V	Volatility of RM3 over the past 3-year
R_CFOCV	The standard deviation of previous 4-year R_CFOC historical data
R_CFOCV3	The standard deviation of previous 3-year R_CFOC historical data
LIG	Implicit local government guarantee measure, equal to the ratio of asset size inverted rank subtracted by 1 to total number of firms with the province subtracted by 1. $LIG = 0.5$ if only one bond issuer in one province-year.
AQ	Accrual quality, measured by the standard deviations of firm's residuals over year t-4 through t of the modified Dechow and Dichev Model.
LNAMT	Log of amount issued
LFLL	Time to maturity in year t
COUPON	Bond coupon rate
BAGE	Bond age
RAT	Bond credit ratings, which is a numerical score from 1 to 6, and larger values mean higher ratings
ROA	Returns on assets
LEV	Leverage ratio, total liabilities/total assets
LNSIZE	Log of firm's total assets
GROWTH	Sales growth rate
SOE	An indicator equal to 1 for stated-owned firms, and 0 otherwise.

This table presents the definitions of the variables.

For the real EM, we follow Roychowdhury (2006), Cohen et al. (2008), Cohen and Zarowin (2010), and Yongtae and Myung (2014) in using discretionary cash flow from operations (R_CFO), discretionary production costs (R_PROC), and discretionary expenses (R_DISX).

Specifically, we run the regression Eq. (2) below using firms in the same industry and year and recover the residual; we calculate R_CFO as the residual of the following equation:

$$\frac{CFO_{i,t}}{ASSET_{i,t-1}} = k_1 \frac{1}{ASSET_{i,t-1}} + k_2 \frac{SALES_{i,t}}{ASSET_{i,t-1}} + k_3 \frac{\Delta SALES_{i,t}}{ASSET_{i,t-1}} + \epsilon_{i,t} \quad (2)$$

where CFO is the cash flow from operation. For easier interpretation, we multiply R_CFO by -1 so that a large value of R_CFO means a high real EM. The intuition behind Eq. (2) is that a firm can manipulate earnings by providing exceptionally high discounts in sales or accounts receivables to book sales early and thus inflate earnings; accordingly, R_CFO is large.

In a similar fashion, we can estimate real EM using discretionary production costs (R_PROC) using regression Eq. (3):

$$\frac{PROD_{i,t}}{ASSET_{i,t-1}} = k_1 \frac{1}{ASSET_{i,t-1}} + k_2 \frac{SALES_{i,t}}{ASSET_{i,t-1}} + k_3 \frac{\Delta SALES_{i,t}}{ASSET_{i,t-1}} + k_4 \frac{\Delta SALES_{i,t-1}}{ASSET_{i,t-1}} + \epsilon_{i,t} \quad (3)$$

where $PROD$ is the production cost. The residual from Eq. (3), i.e., R_PROC , gauges a firm's real EM under the likelihood of a production cost manipulation; a large R_PROC means a high real EM.

Last, a firm can manipulate earnings by using discretionary expenses associated with R&D, sales, and administrative related items. By manipulating these expenses downward, a firm can manipulate its earnings higher. We use the residual from Eq. (4) and multiplied it by (-1) to obtain the R_DISX :

$$\frac{DISX_{i,t}}{ASSET_{i,t-1}} = k_1 \frac{1}{ASSET_{i,t-1}} + k_2 \frac{SALES_{i,t-1}}{ASSET_{i,t-1}} + \epsilon_{i,t} \quad (4)$$

A large R_DISX means a high real EM. Then, we calculate the respective standard deviations, denoted by R_CFOV , R_PROCV , and R_DISXV , to represent the volatilities of the real EM.

3.2.2. Yield spread and decomposition

Previous studies often calculate the yield spread by subtracting the yield of a corporate bond from a maturity-matched government bond. Ang et al. (2016) suggest that it is more accurate to match the entire cashflow of the two bonds, not just the maturity. We follow the methods outlined in Ang et al. (2016). Specifically, we define the yield spread as the difference between the corporate bond yield and the cashflow-matched government bond yield:

$$YS_{ij}(t) = y_{ij}^{CB}(t) - y_{ij}^{TB}(t) \quad (5)$$

where $y_{ij}^{CB}(t)$ is the yield for corporate bond i issued by firm j at time t , which we calculate based on all the bond's characteristics and the transaction price at time t ; $y_{ij}^{TB}(t)$ is the cashflow-matched government bond yield at time t . Then, we

compute the zero-coupon rates of the Chinese government bonds as follows: We take daily transaction records from the WIND database for Chinese government bonds for each transaction date during our sample period that meet the following criteria: (1) there are at least 20 bond transactions, (2) the original time-to-maturity of these bonds spans at least 10 years but no more than 30 years (allowing for the maximum time to maturity of corporate bonds in our sample is strictly less than 30 years), (3) we exclude bonds with a remaining maturity period of less than one month, and (4) we only consider treasury bonds traded in stock exchanges because our corporate bonds are also traded in stock exchanges. Following Svensson (1994),² we fit the following forward rate (f) curve:

$$f(m_{ij}, \beta) = \beta_0 + \beta_1 \exp\left(-\frac{m_{ij}}{\tau_1}\right) + \beta_2 \left[\left(\frac{m_{ij}}{\tau_1}\right) \exp\left(-\frac{m_{ij}}{\tau_1}\right)\right] + \beta_3 \left[\left(\frac{m_{ij}}{\tau_2}\right) \exp\left(-\frac{m_{ij}}{\tau_2}\right)\right] \quad (6)$$

For each transaction date, where m_{ij} refers to the time to occurrence (in years) of the i^{th} cashflow of bond j . The vector $\beta = (\beta_0, \beta_1, \beta_2, \beta_3, \tau_1, \tau_2)$ is the model parameter vector to be estimated. Using the parameterized forward curve, we derive the corresponding zero-coupon treasury bond yield curve at each transaction date t over different maturities, m , $s(m, t)$, according to $s(m, t) = \frac{1}{m} \int_0^m f(x, \beta) dx$.

To find the matching treasury bond yield for corporate bond i issued by firm j at time t , $y_{ij}^{TB}(t)$, we use the corporate bond i 's characteristics, coupon rate, coupon payment frequency, and maturity date, at the time of the transaction, and discount each cashflow using the treasury bond zero-coupon rates, $\{s(m, t)\}$, for maturity T , and coupon C_i^{CB} :

$$P_{ij}^{TB}(t) = \sum_{m=1}^T C_i^{CB} e^{-ms(m,t)} + 100e^{-Ts(T,t)} \quad (7)$$

With the hypothetical treasury bond price, $P_{ij}^{TB}(t)$, we calculate the corresponding yield, $y_{ij}^{TB}(t)$, which we define as the cashflow-matched treasury bond yield for corporate bond i issued by firm j at time t . Eq. (7) effectively prices bond i issued by firm j at time t as a Chinese treasury bond because it uses that series of discount rates (Ang et al., 2017; Duffie & Singleton, 1999), and therefore it is more accurate than just matching for duration or maturity because it controls for all the cashflow effects unique to each corporate bond. We calculate the yield spread at the daily frequency and winsorize at the 99% and 1% levels, and then aggregate to the yearly frequency.

Focusing on the liquidity variable, λ , we follow Schwert (2017) to run Eq. (8) below that depicts the conditional relationship between yield spreads and λ for each year:

$$YS_{ijt} = \alpha + \beta_t^\lambda \lambda_{ijt} + \theta RAT_{ijt} + \sum \gamma Controls + \varepsilon_{ijt} \quad (8)$$

where YS_{ijt} is the yield spread for the bond i in year t issued by firm j and RAT is the rating of the bond. We use the most recent rating on the bond to control for credit risk. Unlike Schwert (2017), we follow Chen and Jiang (2020) to add the ratio of operating income to sales, ratio of debt to assets (LEV), corporate sales growth opportunity ($GROWTH$), firm size (log of total assets, $LNSIZE$), return on assets (ROA), bond age ($BAGE$), and log of issue amount ($LNAMT$) to the model as control variables. The reason is that one may question about the accuracy of Chinese bond ratings, although Livingston et al. (2018) document that Chinese bond ratings contain information content. We expect adding more bond and issuer characteristic variables to alleviate the issues related to missing information caused by possible inefficient bond ratings.

The yield spread between defaultable bonds and risk-free bonds depends on the likelihood of default, the expected loss given default, and on the market price of credit risk, which determines the mapping from physical to risk-neutral probabilities of default (Schwert, 2017). In addition, liquidity also plays a significant role in Chinese corporate bond pricing (Chen & Jiang, 2020). Schwert (2017) also considers tax that contributes to bond yields. Since all investors in China are levied at the same tax rate, 20%, for their gains from corporate bond investment, tax effect is the same for all corporate bonds if any. Thus, we do not incorporate tax effect into our analysis below.

Following Schwert (2017), we use the 1st percentile of the liquidity variable, labeling it λ_{1p} , to benchmark the liquidity of a very liquid corporate bond. The liquidity spread (Φ_{ijt}) is then estimated as

$$\Phi_{ijt} = \beta_t^\lambda (\lambda_{ijt} - \lambda_{1p}) \quad (9)$$

With the liquidity spread known, we estimate the default spread as the remaining portion of the yield spread (γ_{ijt}):

$$\gamma_{ijt} = YS_{ijt} - \Phi_{ijt} \quad (10)$$

We perform a principal components analysis of the liquidity variables to better understand their structure and to reduce dimensionality. The liquidity spread of a corporate bond is non-traded and unobservable. Hence, we estimate it using several empirical proxies for liquidity. Following Jankowitsch et al. (2011), Dick-Nielsen et al. (2012), Schwert (2017), and Abdi and Ranaldo (2017), we include a set of liquidity variables such as *Bond zero trade* (the proportion of days in a year during which a bond has no trade), *Issuer zero trade* (the proportion of days in a year during which none of the bonds issued by an issuer trade), *Trade interval* (the yearly average number of days since a previous trade), *Turnover* (the ratio of yearly trading volume to the bond's amount outstanding), *High-low spread* (the yearly average of the difference between bond daily high and low prices), *Price dispersion* (the yearly average of the daily price dispersion measure), and *CHL spread* (the yearly estimate of the bid-ask spread). The liquidity variables are described in detail in the Supplementary Material, available online. We normalize all

² The Svensson (1994) model produces smaller fitting errors than the Nelson and Siegel (1987) procedure by adding one more term in the parameterized forward curve.

the liquidity measures, including individual ones and their principal components, in the regression analysis for the convenience of result interpretation (Schwert, 2017). Namely, we calculate the liquidity measure for each bond i issued by firm j in year t , L_{ijt}^k , where $k = 1, \dots, 7$ indexes the seven liquidity measures, and then define $\tilde{L}_{ijt}^k = (L_{ijt}^k - \mu^k) / \sigma^k$, where μ^k and σ^k are the mean and standard deviation of L_{ijt}^k across bonds and years and receive our liquidity measure for each bond and year as the score with loadings from principal components analysis. The results of the principal components analysis on all the liquidity matrices are presented in the Supplementary Material, available online. The first three principal components account for approximately 72% of the variations of the liquidity yield spread. Thus, the use of λ_{ijt} is warranted.³

3.2.3. Multiple regression model

We use a multiple regression model to examine the impact of EMU on the yield spread, liquidity spread, and default spread:

$$y_{ijt} = \alpha + \beta EMU_{ij,t-1} + \sum \gamma_1 \text{Bond controls}_{ijt} + \sum \gamma_2 \text{Firm controls}_{j,t-1} + \text{YearFE} + \text{industryFE} + \varepsilon_{ijt} \quad (11)$$

where y_{ijt} represents the yield spread, liquidity spread, or default spread of firm i for bond j at time t and $EMU_{ij,t-1}$ is the accrual-based or real EM volatilities at $t-1$. *Bond controls* include log of amount issued (*LNAMT*), time to maturity (*LFFL*), coupon rate (*COUPON*), the difference between the settlement date and the issuing date (*BAGE*), and bond rating (*RAT*) defined as the numerical scores bond rating from 1 to 6 with large values meaning better ratings. Firm controls include accrual quality (*AQ*), return on assets (*ROA*), financial leverage (*LEV*), log of firm year-end total assets (*LNSIZE*), sales growth rate (*GROWTH*), and the nature of ownership (*SOE*) defined as an indicator equaling one for stated-owned enterprises, and zero otherwise.⁴ Furthermore, we also control for

³ While bond ratings, other bond characteristics, and issuer characteristics capture some of the differences in credit risk among different bonds, there may exist variation in credit risk that these variables do not control for. Liquidity and default risk may be positively correlated. For this concern, we cannot apply alternative decomposition approaches to bond yield spreads, as Schwert (2017) did, due to data limitation. But we try to use different liquidity measures to estimate liquidity spread and default spread, and our results are quantitatively equivalent from the yield spread decomposition using either the liquidity index constructed via principal components analysis or individual liquidity measures. This, to the extent, lends support to the validity of our yield spread decomposition. Another potential demerit of the transaction-based approach of yield spread decomposition is that the 1st percentile of liquidity may still be very illiquid relative to central government bonds, which implies that the liquidity spread captures relative liquidity in the corporate bond market but not the absolute level of liquidity against the benchmark. We admit such limitations due to the unavailability of data that are required by alternative spread decomposition approaches.

⁴ All variables are defined in Table 2.

year and industry fixed effects. We cluster the standard errors in Eq. (11) at the issuer level.

4. Results and discussions

4.1. Summary statistics

We present the summary statistics of the sample in Panel B of Table 1. The mean yield spread (*YS*) is approximately 2.00% with a standard deviation of approximately 1.20% while the mean liquidity spread is approximately 39 bps with a standard deviation of 41 bps. Thus, our yield spread decomposition shows that default risk accounts for around 80.68% of the bond yield spread on average, while liquidity risk plays a secondary role to default risk in corporate bond pricing. The averages of EMU measures, *DAV*, *DAV_EBIT*, *R_CFOV*, *R_PRODV*, and *R_DISX* are 0.035, 0.037, 0.161, 0.389, and 0.011, respectively; the average of coupon rate (*COUPON*) is approximately 5.71%; and the average of financial leverage (*LEV*) is 0.599.

4.2. Baseline results

Table 3 presents our baseline results on the effects of EMU on corporate bond yield spreads.⁵ Panel A presents the univariate analysis results, and Panel B presents the multivariate analysis results from the model of Eq. (11).

We partition the sample into two groups based on the medians of the EMU. We then conduct t -test for the difference in the yield spreads between the two groups. Panel A shows that all the test results are significant at least at the 5% level, which suggests that bonds issued by firms with high EMU exhibit larger yield spreads.

Panel B shows that the coefficients of all five EMU variables (*DAV*, *DAV_EBIT*, *R_PRODV*, *R_DISXV*, and *R_CFOV*) are positive and significant at the 1% or 5% level (the coefficients are 245.807, 207.246, 11.450, 443.081, and 28.622, respectively). Consistent with the results in Panel A, when EM volatility is high, the yield spread is also large. Hence, the baseline findings support the results in Chen et al. (2015).⁶ We note that the economic magnitudes of the effects of the five EMU measures on the yield spreads are 14.01 bps (245.807×0.057), 13.06 bps (207.246×0.063), 8.15 bps (11.450×0.712), 8.42 bps (443.081×0.019), and 7.76 bps (28.622×0.271), respectively, in terms of the increase of the yield spreads led to by one standard deviation increase in the EMU measures. This suggests that both accrual EM volatility and real EM volatility impact on the yield spreads

⁵ Correia (2015) demonstrates that maintaining singleton groups, groups with only one observation, in linear regressions where fixed effects are nested within clusters can overstate statistical significance and lead to incorrect inference. Due to this problem, the *reghdfe* package in Stata automatically drops singletons. Therefore, the number of observations reported in most regression tables is less than the sample size of 596.

⁶ The results for the impact of EMU on yield spread are qualitatively the same if we use the initial larger sample. They are available upon request.

Table 3
The impact of EMU on yield spread.

Panel A: Univariate analysis

EMU Metrics	Dependent variable: <i>Yield spread</i> (YS in bps)				Differences	T-value
	High EMU		Low EMU			
	<i>N</i>	Mean	<i>N</i>	Mean		
<i>DAV</i>	298	232.602	298	168.749	63.853***	6.72
<i>DAV_EBIT</i>	298	229.635	298	171.715	57.921***	6.06
<i>R_PROD</i>	298	216.471	298	184.879	31.592**	3.24
<i>R_DISXV</i>	297	221.406	299	180.083	41.322***	4.26
<i>R_CFOV</i>	298	217.526	298	183.824	33.701***	3.46

Panel B: Multivariate analysis

	Dependent variable: <i>Yield spread</i> (YS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PROD</i>	<i>EMU = R_DISX</i>	<i>EMU = R_CFO</i>
<i>EMU</i>	245.807*** (3.37)	207.246*** (3.14)	11.450*** (3.05)	443.081** (2.04)	28.622** (2.53)
<i>AQ</i>	0.623*** (9.01)	0.621*** (8.91)	0.626*** (9.10)	0.633*** (9.11)	0.629*** (9.10)
<i>LNAMT</i>	−3.131 (−0.33)	−3.349 (−0.35)	−3.236 (−0.32)	−3.376 (−0.33)	−3.078 (−0.30)
<i>LFFL</i>	−2.679 (−1.16)	−2.772 (−1.20)	−2.389 (−1.05)	−2.613 (−1.13)	−2.398 (−1.05)
<i>COUPON</i>	20.796*** (2.96)	20.474*** (2.90)	21.419*** (2.99)	21.812*** (3.05)	21.533*** (3.00)
<i>BAGE</i>	−1.441 (−0.48)	−1.312 (−0.43)	−1.792 (−0.59)	−1.677 (−0.55)	−1.764 (−0.58)
<i>RAT</i>	−48.738*** (−5.11)	−48.775*** (−5.07)	−48.977*** (−4.94)	−48.788*** (−4.88)	−48.992*** (−4.90)
<i>ROA</i>	−9.049*** (−5.43)	−9.043*** (−5.42)	−9.189*** (−5.37)	−9.172*** (−5.41)	−9.199*** (−5.37)
<i>LEV</i>	−8.877 (−0.18)	−7.173 (−0.15)	−21.657 (−0.44)	−20.883 (−0.42)	−21.674 (−0.44)
<i>LNSIZE</i>	5.356 (0.60)	5.392 (0.60)	3.895 (0.42)	5.290 (0.54)	4.196 (0.45)
<i>GROWTH</i>	−13.880* (−1.66)	−13.604 (−1.63)	−9.745 (−1.19)	−10.977 (−1.44)	−10.037 (−1.24)
<i>SOE</i>	−35.688** (−2.56)	−35.677** (−2.53)	−34.335** (−2.42)	−34.709** (−2.39)	−34.467** (−2.41)
Constant	339.160* (1.84)	345.018* (1.85)	385.120** (1.99)	351.385* (1.84)	373.664* (1.93)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	595	595	595	595	595
Adj. <i>R</i> ²	0.483	0.481	0.473	0.473	0.473

This table presents the baseline analysis on the impact of EMU on yield spreads. Panel A presents the univariate analysis, where we partition the sample into two groups based on the medians of the EMU metrics, of which High EMU group consists of observations with EMU metrics above the medians, and the rest belong to Low EMU group. We then conduct *t*-test for the difference in yield spreads between the two groups. Panel B presents the multivariate analysis from the model of Eq. (11). Singletons (clusters with only one observation) are dropped for robustness. The *t*-statistics are reported in parentheses and industry and year fixed effects are included in all regressions. The *t*-statistics reported in parentheses are based on standard errors clustered by issuer. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in Table 2.

with both statistical and economic significance when controlling for bond and firm characteristics. The control variables, if significant, carry the expected signs. For instance, the coefficients of *ROA*, and *SOE* are consistently negative and significant at the 1% or 5% level in all five columns, suggesting that when a firm has high profitability, or it is state-owned, the yield spread is less.

4.3. Liquidity and default yield spreads

The results in Section 4.2 are consistent with those in the literature (Duffie & Lando, 2001). However, we do not know if the impact of EMU is primarily upon the liquidity and/or the default yield spreads. Hence, we decompose the yield spread into liquidity and default yield spreads and reexamine the

Table 4
The impact of EMU on liquidity and default spreads.

Panel A: EMU and liquidity spread

	Dependent variable: <i>Liquidity spread (LS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PROD</i>	<i>EMU = R_DISX</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	28.407* (1.77)	22.314 (1.57)	0.696 (0.48)	59.448 (1.22)	2.610 (0.67)
Constant	−204.852*** (−4.31)	−203.883*** (−4.29)	−199.711*** (−4.21)	−204.009*** (−4.25)	−200.661*** (−4.23)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	595	595	595	595	595
Adj. <i>R</i> ²	0.201	0.200	0.198	0.199	0.198

Panel B: EMU and default spread

	Dependent variable: <i>Default spread (DS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PROD</i>	<i>EMU = R_DISX</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	217.400*** (3.45)	184.932*** (3.27)	10.754*** (3.22)	383.633* (1.86)	26.012*** (2.63)
Constant	544.012*** (3.05)	548.901*** (3.05)	584.831*** (3.15)	555.395*** (3.02)	574.325*** (3.08)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	595	595	595	595	595
Adj. <i>R</i> ²	0.467	0.465	0.459	0.458	0.458

This table shows the estimates of the impact of EMU on the liquidity and default components of the yield spread from the model of Eq. (11). All regressions control for year and industry fixed effects. Singletons (clusters with only one observation) are dropped for robustness. We do not report the coefficients of the control variables for brevity and denote them by *Controls*. Panel A presents the estimates of the relationship between EMU and the liquidity spread, and Panel B presents the estimates of the impact of EMU on the default spread. The t-statistics are reported in parentheses. The t-statistics reported in parentheses are based on standard errors clustered by issuer. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in Table 2.

impact of EMU on the yield spreads. The results are presented in Panels A and B of Table 4. For brevity, we do not present the coefficients of control variables.

In Panel A of Table 4, using the liquidity yield spread as the dependent variable, the coefficients of the EMU variables in columns (2)–(5) are not significant, while the coefficient of *DAV* in column (1) is only marginally significant at the 10% level. This indicates that the impact of EMU on liquidity yield spread is minimal. In contrast, the same set of coefficients in Panel B of Table 4, are positively significant at the 1% or 10% level and most importantly, the magnitudes of the coefficients are economically significant. Thus, the impact of EMU on the corporate bond yield spread is primarily channeled through the default yield spread. The importance of the default yield spread relative to the liquidity yield spread echoes the findings of Schwert (2017) that purports that default risk accounts for 74%–84% of the average yield spread in municipal bonds. The baseline results in Table 4 remain qualitatively the same if we use two-way clustering robust standard errors proposed by Petersen (2009).⁷

4.4. Robustness checks

4.4.1. Alternative measures of EMU

The results in Sections 4.3 and 4.4 suggest that the impact of EMU volatility on the bond yield spread is primarily on the default yield spread. For robustness, we examine the core results using alternative measures of EM volatility. For alternative measures of EM volatility, we follow Cohen and Zarowin (2010) and Zang (2012) to define three types of aggregate real earnings management proxies: (1) $RM1 = R_PROD - R_CFO - R_DISX$, (2) $RM2 = R_PROD - R_DISX$, and (3) $RM3 = -R_CFO - R_DISX$, respectively. Then, we calculate the volatilities of *RM1* to *RM3* using the respective standard deviations in the previous three years for the variables and denote the measures as (*RM1_V*), (*RM2_V*), and (*RM3_V*), respectively. In addition, following Chen et al. (2015), we define *R_CFOCV* as the estimated residual of Eq. (12) for each industry given each year.

$$R_CFO_{jt} = \beta_{0t} + \beta_{1t}R_PROD_{jt} + \beta_{2t}R_DISX_{jt} + \varepsilon_{jt} \quad (12)$$

Then, we use the standard deviations of (*R_CFOCV*) in the previous four years and (*R_CFOCV3*) in the previous three years to capture the respective volatilities of *R_CFO*. The

⁷ The results are available upon request.

Table 5
The impact of EMU on yield, liquidity, and default spreads: Instrumental variable approach.

Panel A: EMU and yield spread					
	Dependent variable: <i>Yield spread (YS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	244.997*** (3.37)	206.525*** (3.14)	11.439*** (3.05)	438.685** (2.03)	28.382** (2.51)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	596	596	596	596	596
Adj. <i>R</i> ²	0.468	0.466	0.458	0.457	0.457
Panel B: EMU and liquidity spread					
	Dependent variable: <i>Liquidity spread (LS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	28.581* (1.78)	22.442 (1.58)	0.708 (0.49)	59.312 (1.21)	2.557 (0.66)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	596	596	596	596	596
Adj. <i>R</i> ²	0.178	0.177	0.175	0.176	0.175
Panel C: EMU and default spread					
	Dependent variable: <i>Default spread (DS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	216.416*** (3.45)	184.083*** (3.26)	10.731*** (3.21)	379.373* (1.84)	25.825*** (2.62)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	596	596	596	596	596
Adj. <i>R</i> ²	0.451	0.450	0.443	0.442	0.442

This table presents the estimates of the impact of EMU on the yield, liquidity, and default spreads from the model of Eq. (11) employing instrumental variable approach. We use the technique sketched in Section 4.4.6 to construct the instruments for EMU measures. We partial out industry and year dummies by applying Frisch-Waugh theorem to avoid non-invertible variance-covariance matrices, and thus no constant term is reported. All regressions control for year and industry fixed effects. We do not report the coefficients of the control variables for brevity and denote them by *Controls*. Panel A presents the estimates of the impact of EMU on the yield spread; Panel B presents the estimates of the relationship between EMU and the liquidity spread; and Panel C presents the estimates of the impact of EMU on the default spread. The t-statistics are reported in parentheses. The t-statistics reported in parentheses are based on standard errors clustered by issuer. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in Table 2.

results are presented in Panels A to C of Table S2, available online. The findings presented in Table S2 are consistent with those in Tables 3 and 4

4.4.2. Sub-sample analysis

We conduct a third robustness check based on the sub-sample after excluding the data generated during the global financial crisis during 2008–2009 to mitigate the influence of bond yield spreads due to the prevailing adverse economic environment. The findings are presented in Panels A to C of Table S3, available online. The findings show that the coefficients of the EM volatility measures (*DAV*, *DAV_EBIT*, *R_PRODV*, *R_DISXV*, and *R_CFOV*) are all positive and

significant for the yield spread and the default yield spread panels but not for the liquidity yield spread panel. The findings presented in Table S3 are consistent with those in Tables 3 and 4 and S2.

4.4.3. Additional control variables

Theoretical literature (Duffie & Lando, 2001) documents that the incomplete accounting information level also has a significant impact on a firm's real asset value distribution, and thus its credit risk. Allowing for this, to mitigate the possible omitted variable problem, we incorporate EM level variables (*DA*, *DA_EBIT*, *R_PROD*, *R_DISX*, and *R_CFO*) into Eq (11) as additional control variables and conduct a similar analysis

like in Tables 3 and 4 in Table S4, available online. Consistent with the evidence aforementioned, there is still no clear evidence on the impacts on the liquidity spread of EMU. Consequently, the effects of EMU on default risk entirely dominate those on liquidity risk. To sum up, this line of analysis again lends strong support to hypothesis *H1A*.

4.4.4. Instrumental variables

To further address or alleviate endogeneity issues, we use instrumental variable (IV) approach to our empirical work. It is quite difficult to find good IVs that are highly related to EMU variables, and at the same time are mean-independent of the error term in Eq (11). In this paper, we adopt the technique applied by Lewbel (2012), that exploits the presence of heteroscedasticity in the regression residuals, to find IVs. This technique is also used by recent empirical studies (e.g., Gong et al., 2018). We sketch the intuition below. Assume that we are interested in estimating the following linear triangular model:

$$y_1 = \alpha_1 + X'\beta_1 + \gamma_1 y_2 + \varepsilon_1 \quad (13)$$

$$y_2 = \alpha_2 + X'\beta_2 + \varepsilon_2, \quad (14)$$

where y_2 is the endogenous regressor, and X is a vector of observed exogenous regressors. Besides the standard assumptions that $E(X\varepsilon_1) = E(X\varepsilon_2) = 0$, and $cov(X, \varepsilon_1\varepsilon_2) = 0$, if the assumption in the presence of heteroscedasticity, $cov(X, \varepsilon_2^2) \neq 0$, is satisfied, then $X\varepsilon_2$ can be used as an instrument for y_2 . The rationale is that the assumption that $cov(X, \varepsilon_1\varepsilon_2) = 0$ can guarantee that $X\varepsilon_2$ is uncorrelated with ε_1 (the exclusion condition for valid instruments), whereas the presence of heteroscedasticity, $cov(X, \varepsilon_2^2) \neq 0$, supports the relevance condition that there is no correlation between $X\varepsilon_2$ and y_2 . Meeting these two requirements justifies the validity of $X\varepsilon_2$ as an instrument.

Our unreported results (Breusch-Pagan test) confirm the existence of heteroscedasticity in Eq (11) ($cov(X, \varepsilon_2^2) \neq 0$) for all regressions presented in Tables 3 and 4. This implies that we can use the technique outlined above with confidence. The IV regression results are presented in Table 5.⁸ For brevity, we do not present the coefficients of the control variables. Clearly, the results in Table 5 again indicate that EMU is positively associated with the yield spread and the default yield spread but not with the liquidity yield spread, which is highly consistent with those in Tables 3 and 4.

4.4.5. Change model

To address the endogeneity concern that our results could be confounded by omitted variable bias, we use a change model by taking first order differences of all time-varying variables and dropping those time-invariant control variables in Eq (11). Table S5, available online, presents the findings.

⁸ In the IV regressions, we partial out industry and year dummies by applying Frisch-Waugh theorem to avoid non-invertible variance-covariance matrices, and thus no constant term is reported in Table 5.

Evidently, the results in Table S5 suggest that the change in EMU is positively associated with the change in yield spread and the change in default yield spread but not with the change in liquidity yield spread, which is highly consistent with those in Tables 3 and 4. Therefore, omitted variable issue could not be a big concern.

4.4.6. Individual liquidity measures

We also decompose the yield spread into liquidity spread and default spread based on the seven individual liquidity measures separately. We then examine the impact of EMU on liquidity premium and default spread as we did in Table 4. The unreported results continue to show that EMU dominantly affects the default spread over the liquidity spread, which is highly consistent with the evidence discussed previously. On the one hand, this shows that hypothesis *H1A* is strongly supported and *H1B* is rejected. On the other hand, this line of analysis also lends support to the application of yield spread decomposition approach.

4.5. The impact of implicit government guarantee

4.5.1. Implicit guarantees from the central government

We divide the sample into two sub-samples based on the median of firm size measured by log of firm year-end total assets to examine the impact of implicit guarantees from the central government. We then conduct the empirical exercises specified by model (11) for the two subsamples and report the results in Table 6. For brevity, we do not present the coefficients of the control variables.

Panel A of Table 6 presents the effects of EMU on the yield spread using the sample with low level of implicit central government guarantee. Columns (1)–(3) and (5) show that EMU has a positive effect on the yield spread with statistical significance at least at the 5% level. Panel B of Table 6 presents the effects of EMU on the yield spread using the sample with high level of implicit central government guarantee. The results in Panel B clearly indicate that EMU has no significant effect on the yield spread issued by firms with high level of implicit central government guarantees.

Panel C of Table 6 presents the effects of EMU on the liquidity spread using the sample with low level of implicit central government guarantee. Columns (1)–(5) show that EMU has a positive effect on the liquidity spread with statistical significance at least at the 5% level. Panel D of Table 6 presents the effects of EMU on the liquidity spread using the sample with high level of implicit central government guarantee. The results in Panel B clearly indicate that EMU has no significant effect on the liquidity spread issued by firms with high level of implicit central government guarantees.

Panels E and F of Table 6 present the effects of EMU on the default spread using the sample with low and high level of implicit central government guarantees, respectively. The results in Panels E and F nearly mirror those in Panels A and B. In short, the results in these two Panels suggest that EMU positively affects the default spread for the group of firms without or with low level of implicit guarantees from the

Table 6

EMU, central government implicit guarantees, and yield, liquidity and default spreads.

Panel A: EMU and yield spread: Low level of central government implicit guarantees

	Dependent variable: <i>Yield spread</i> (YS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	411.566*** (3.90)	360.787*** (3.97)	12.343** (2.52)	529.322 (1.62)	35.113*** (2.77)
Constant	673.720** (2.36)	669.470** (2.32)	755.935** (2.49)	684.800** (2.30)	740.351** (2.44)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	297	297	297	297	297
Adj. <i>R</i> ²	0.581	0.578	0.553	0.555	0.555

Panel B: EMU and yield spread: High level of central government implicit guarantees

	Dependent variable: <i>Yield spread</i> (YS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	95.895 (0.84)	81.922 (0.81)	4.659 (1.00)	22.075 (0.08)	7.643 (0.51)
Constant	560.373** (2.04)	562.845** (2.03)	588.372** (2.21)	604.352** (2.22)	592.590** (2.22)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	298	298	298	298	298
Adj. <i>R</i> ²	0.379	0.379	0.378	0.378	0.378

Panel C: EMU and liquidity spread: Low level of central government implicit guarantees

	Dependent variable: <i>Liquidity spread</i> (LS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	64.982** (2.36)	56.127** (2.28)	3.549*** (2.75)	151.408** (2.32)	11.483*** (3.30)
Constant	−106.646 (−1.32)	−107.168 (−1.32)	−90.814 (−1.12)	−111.194 (−1.39)	−95.042 (−1.18)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	297	297	297	297	297
Adj. <i>R</i> ²	0.175	0.172	0.160	0.165	0.167

Panel D: EMU and liquidity spread: High level of central government implicit guarantees

	Dependent variable: <i>Liquidity spread</i> (LS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	3.880 (0.12)	3.236 (0.11)	−1.287 (−0.60)	−18.619 (−0.14)	−4.891 (−0.78)
Constant	−272.671*** (−2.97)	−272.529*** (−2.93)	−265.934*** (−2.99)	−269.375*** (−3.00)	−262.198*** (−2.95)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	298	298	298	298	298
Adj. <i>R</i> ²	0.220	0.220	0.221	0.220	0.222

Table 6 (continued)

Panel E: EMU and default spread: Low level of central government implicit guarantees

	Dependent variable: <i>Default spread (DS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	346.584*** (3.59)	304.660*** (3.66)	8.794** (1.99)	377.914 (1.18)	23.630** (2.08)
Constant	780.366*** (2.81)	776.638*** (2.78)	846.749*** (2.90)	795.994*** (2.76)	835.393*** (2.86)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	297	297	297	297	297
Adj. <i>R</i> ²	0.555	0.553	0.532	0.533	0.532

Panel F: EMU and default spread: High level of central government implicit guarantees

	Dependent variable: <i>Default spread (DS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	92.016 (0.90)	78.686 (0.89)	5.946 (1.40)	40.694 (0.18)	12.534 (0.88)
Constant	833.044*** (3.13)	835.374*** (3.13)	853.305*** (3.31)	873.727*** (3.33)	854.788*** (3.30)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	298	298	298	298	298
Adj. <i>R</i> ²	0.343	0.343	0.343	0.342	0.343

This table presents the estimates of the impact of EMU on the bond yield, liquidity, and default spreads from the model of Eq. (11), based on the two sub-samples, respectively. Panels A, C, and E present the results using the sub-sample with low level of implicit government guarantees from the central government, where the issuers with firm size being lower or equal to the median of the distribution of firm size (*LNSIZE*), while Panels B, D, and F present the results using the complement sub-sample. Singletons (clusters with only one observation) are dropped for robustness. The t-statistics based on standard errors clustered by issuer are reported in parentheses, and industry and year fixed effects are included in all regressions. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in Table 2.

central government but does not impact on the default spread for the group of firms with high level of implicit guarantees from the central government. In conclusion, the results in Table 6 lend support to hypotheses *H2A* and *H2B*. Hence, implicit guarantees from the central government not only weaken the effects of EMU on the yield spread, but also weaken the effects on both the default and liquidity components of the yield spread.

Although the results in Table 6 demonstrate that EMU almost has no effect on the cost of debt or the three types of spreads for the firms with high level of implicit guarantees from the central government, the analyses do not yet provide information on which type of firms in terms of more precise distribution of size benefits more from the guarantee or which type of firms in terms of more precise distribution of size exposes to more risk due to lack of such guarantee. We now address this issue by examining the impact of EMU on the yield spread, liquidity spread and default spread across the full distribution of firm size. More specifically, we compute the logarithm of firm year-end total assets for each quartile of the distribution of firm size. We then reexamine the four regression equations according to Eq (11) with EMU measures, *DAV*, and *DAV_EBIT*, taken as examples, as independent variables, respectively, where the regressions are run for each quartile of the firm size distribution.

Fig. 1 depicts the estimated coefficient, β , from each of these 4 regressions based on the two EMU measures and indicates whether the estimates are significant at the 5% level. Panels (a) and (b) show that EMU disproportionately impacts on the yield spread in the lower part of the firm size distribution, but does not impact on it in the upper part of the firm size distribution. Panels (e) and (f) deliver similar information regarding the effects of EMU on the default spread. Panels (c) and (d) carries even stronger information on the impacts of EMU on the liquidity spread, which shows that the positive role played by EMU in liquidity spread only works for the firms with size below the lower quartile of the size distribution. In sum, the evidence revealed by Fig. 1 is highly consistent with those reported in Table 6, which means that by and large EMU has no effect on the cost of debt or default risk for the firms with high level of implicit guarantees from the central government.

4.5.2. Implicit guarantees from local governments

We investigate the role played by implicit guarantees from local governments in the effects upon EMU on the cost of debt or the yield spread by following Liu et al. (2017) to use a relative firm size measure in their located provinces, *LIG*, which is defined as the ratio of asset size inverted rank

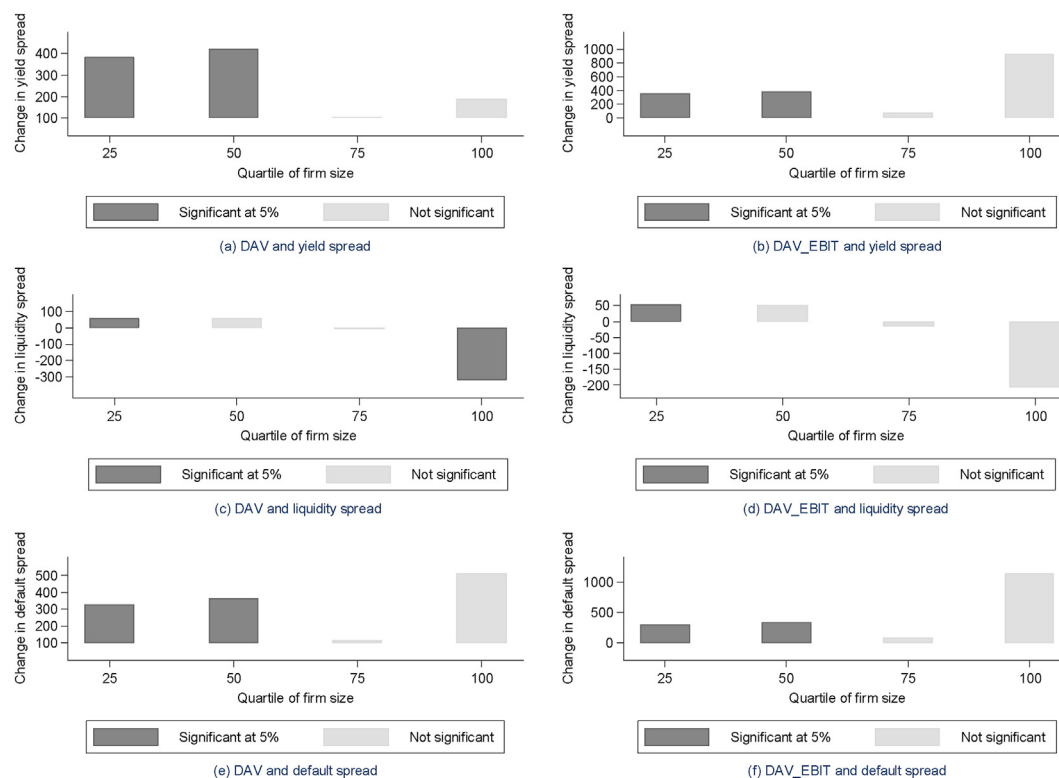


Fig. 1. The impact of EMU on yield, liquidity and default spreads, respectively, for issuers with different degrees of implicit guarantees from the central government. Each bar in the figure represents the estimated impact of EMU (measured by *DAV* and *DAV_EBIT*) on yield, liquidity and default spreads, respectively, on a specific quartile of the firm size (logarithm of firm year-end total assets) distribution. Dark bars represent estimates significant at the 5% or even stronger level after adjusting the standard errors for issuer clustering. Light bars represent statistically insignificant estimates. Specifically, we report the estimates of β from the 4 separate regressions from the model of Eq. (11) for each sub-sample partitioned by the quartiles. Panels (a) and (b) represent the estimates of the impact of EMU on the yield spread, using the EMU metrics, *DAV* and *DAV_EBIT*, respectively; Panels (c) and (d) represent the estimates of the impact of EMU on the liquidity spread, using the EMU metrics, *DAV* and *DAV_EBIT*, respectively; and Panels (f) and (e) represent the estimates of the impact of EMU on the default spread, using the EMU metrics, *DAV* and *DAV_EBIT*, respectively.

subtracted by 1 to total number of firms within the province subtracted by 1, and 0.5 if only one bond issuer in one province-year. We then divide the sample into two subsamples based on the median of *LIG*, and conduct the empirical exercises specified by model (11) for the two subsamples. We report the results in Table 7. For brevity, we do not present the coefficients of the control variables. The patterns of results in Table 7 are qualitatively the same as those in Table 6. That is, EMU has no effect on the cost of debt or default risk for the firms with high level of implicit guarantees from the local government.

4.5.3. Implicit guarantees: SOEs vs. Non-SOEs

We measure implicit government guarantees based on firm size. One concern may be that our measure captures the effect of government control instead of issuer size as government-controlled firms tend to be larger. To address this concern, first we have controlled for ownership structure by including SOE status indicator in Tables 6–7, which show that the existence of the effect of implicit government guarantees is unlikely driven by SOE status. To address this concern more

thoroughly, we further distinguish between large issuers controlled by central or local governments and large issuers controlled by private shareholders to see whether there are differences in the effect between these firms. We present this line of analysis in Tables S6–S9, available online.

Table S6 shows the effect of central government guarantee for SOEs. Panel A presents the effects of EMU on the yield spread using the sample with low level of implicit central government guarantee. Columns (1)–(2) and (5) show that EMU has a positive effect on the yield spread with statistical significance at least at the 10% level. Panel B presents the effects of EMU on the yield spread using the sample with high level of implicit central government guarantee. The results in Panel B clearly indicate that EMU has no significant effect on the yield spread issued by firms with high level of implicit central government guarantees. However, we do not find the central government implicit guarantee effect on the liquidity component for SOEs as shown in Panels C and D. Finally, the results in Panels E and F nearly mirror those in Panels A and B. In short, Panels E and F results suggest that EMU positively affects the default spread for the group of firms without or with low level of implicit guarantees from the

Table 7

EMU, local government implicit guarantees, and yield, liquidity and default spreads.

Panel A: EMU and yield spread: Low level of local government implicit guarantees

	Dependent variable: <i>Yield spread</i> (YS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	328.868*** (3.35)	273.994*** (3.16)	16.779** (2.46)	684.775*** (3.07)	53.984*** (4.22)
Constant	585.943** (2.21)	593.905** (2.21)	632.102** (2.23)	552.189* (1.94)	614.001** (2.17)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	297	297	297	297	297
Adj. <i>R</i> ²	0.558	0.555	0.533	0.539	0.536

Panel B: EMU and yield spread: High level of local government implicit guarantees

	Dependent variable: <i>Yield spread</i> (YS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	45.364 (0.41)	32.940 (0.30)	4.635 (0.96)	−125.770 (−0.39)	5.772 (0.40)
Constant	96.410 (0.42)	98.695 (0.43)	103.100 (0.44)	107.427 (0.46)	100.044 (0.43)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	296	296	296	296	296
Adj. <i>R</i> ²	0.390	0.390	0.391	0.390	0.390

Panel C: EMU and liquidity spread: Low level of local government implicit guarantees

	Dependent variable: <i>Liquidity spread</i> (LS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	37.013* (1.95)	31.187* (1.93)	1.300 (0.87)	70.430 (1.44)	7.113** (2.03)
Constant	−84.421 (−1.39)	−83.525 (−1.37)	−80.582 (−1.32)	−87.820 (−1.43)	−80.869 (−1.33)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	297	297	297	297	297
Adj. <i>R</i> ²	0.210	0.209	0.199	0.202	0.203

Panel D: EMU and liquidity spread: High level of local government implicit guarantees

	Dependent variable: <i>Liquidity spread</i> (LS in bps)				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	20.931 (0.64)	14.996 (0.47)	0.222 (0.13)	43.349 (0.38)	0.194 (0.04)
Constant	−237.178*** (−3.24)	−236.101*** (−3.22)	−234.398*** (−3.21)	−236.180*** (−3.22)	−234.511*** (−3.21)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	296	296	296	296	296
Adj. <i>R</i> ²	0.226	0.226	0.225	0.226	0.225

Table 7 (continued)

Panel E: EMU and default spread: Low level of local government implicit guarantees

	Dependent variable: <i>Default spread (DS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	291.856*** (3.36)	242.807*** (3.17)	15.479** (2.35)	614.345*** (3.09)	46.871*** (3.55)
Constant	670.364*** (2.71)	677.430*** (2.69)	712.684*** (2.70)	640.009** (2.41)	694.870*** (2.63)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	297	297	297	297	297
Adj. <i>R</i> ²	0.542	0.539	0.519	0.525	0.522

Panel F: EMU and default spread: High level of local government implicit guarantees

	Dependent variable: <i>Default spread (DS in bps)</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>EMU = DAV</i>	<i>EMU = DAV_EBIT</i>	<i>EMU = R_PRODV</i>	<i>EMU = R_DISXV</i>	<i>EMU = R_CFOV</i>
<i>EMU</i>	24.433 (0.27)	17.943 (0.19)	4.413 (1.09)	−169.120 (−0.55)	5.578 (0.46)
Constant	333.588 (1.43)	334.796 (1.44)	337.498 (1.44)	343.607 (1.45)	334.555 (1.43)
Controls	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	296	296	296	296	296
Adj. <i>R</i> ²	0.338	0.338	0.339	0.338	0.338

This table presents the estimates of the impact of EMU on the bond yield, liquidity, and default spreads from the model of Eq. (11), based on the two sub-samples, respectively. Panels A, C, and E present the results using the sub-sample with low level of implicit government guarantees from the local governments, where the issuers with *ILG* being lower or equal to the median of the distribution of this measure, while Panels B, D, and F present the results using the complement sub-sample. Singletons (clusters with only one observation) are dropped for robustness. The t-statistics based on standard errors clustered by issuer are reported in parentheses, and industry and year fixed effects are included in all regressions. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. All variables are defined in Table 2.

central government but does not impact on the default spread for the group of firms with high level of implicit guarantees from the central government.

Table S7, available online, shows the effect of central government guarantee for non-SOEs. We find similar patterns as those in Table S6. That is, the effect of implicit guarantee is significant for bond yield spread and its default component but not for the liquidity part. One interesting observation deserving to be pointed out is that the magnitude of coefficients on EMU in both Panels A and E of Table S7 is larger than its counterpart in Table S6. This fact suggests that issuers controlled by the government enjoy a stronger level of government guarantees compared to privately controlled firms to some extent.

Tables S8 and S9, available online, present the effect of local government guarantees for SOEs and non-SOEs, respectively. Clearly, the coefficients on EMU in all panels of Table S8 carry no statistical significance, suggesting that the implicit guarantee effects from local governments for SOEs completely offset the positive effect of EMU on bond yield spreads and its two components. In contrast, the results in Table S9 indicate that for non-SOEs only those issuers with relatively large size among their peers in corresponding local economies do enjoy an implicit guarantee effect. This finding

is natural given the dominance of SOEs in the Chinese economy.⁹ Combined, our results on the implicit guarantee effects could not be driven by SOE status, and firms controlled by the government enjoy a stronger level of implicit guarantees at least to the extent as expected.

5. Conclusion and policy implications

We examine the impact of EMU on bond yield spreads in China. EMU is an important source of idiosyncratic risk for a firm and thus significantly contributes to the yield spreads of corporate bonds. Our research has two main motivations. First, the literature does not distinguish between liquidity and default risk yield spread. Several studies, such as Black et al. (2016) and Clark and Baccar (2018), have documented the significance of liquidity yield spread in determining the yield of corporate bonds. Thus, a distinction between liquidity and default risk can provide guidance to firms in managing their risk exposure when issuing bonds. Second, in emerging markets, implicit government guarantees

⁹ In fact, in almost all regressions, SOE indicator carries significantly negative signs, manifesting SOEs' dominance in the economy.

are common. Surprisingly, little is known about the moderating effect of such guarantees on the impact of the EMU of a yield spread on a bond. Our findings advance the research literature in these two regards. Additionally, our study also extends the TBTF literature by investigating the possible role played by implicit government guarantees in real sectors, including implicit guarantees from both central government and local government perspectives.

Our findings suggest that EMU primarily drives the default yield spread of a corporate bond and that its impact on the liquidity yield spread is minimal. Our findings are robust to a battery of alternative metrics of yield spreads and empirical specifications. In addition, we find that the implicit guarantees from the central and local governments can significantly weaken the impact of EMU on both the overall bond yield spread and the default component.

Our findings provide important policy implications for policy makers and corporate managers in China and other emerging markets. For regulators, if their policy objective is to lower firms' borrowing costs in the bond market to stimulate economic growth, removing the market frictions to improve liquidity would not be enough since the default premium is a major contributing factor of the corporate bond yield spread. Second, for corporate managers, to lower borrowing costs, they need to make more effort to reduce default risk rather than those being favorable to improve bond liquidity to bond investors when incomplete accounting information, like EMU, contributes more to default risk than liquidity risk. Collectively, it is paramount important for both policy makers and managers to distinguish the pricing implication of bond pricing factors so that they can take effective measures to lower the borrowing costs in bond markets, which is especially relevant in emerging markets, like China, featured with nascent and underdeveloped bond markets.

Declaration of Competing Interest

We have no conflicts of interest to disclose.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bir.2020.11.001>.

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