# Corporate Bonds with Implicit Government Guarantees

Yifei Li, Yuan Tian, Tong Yu, and Ran Zhang[1]

May 2020

[1]Li is from the College of Business, University of Nevada, Reno; email: yifeil@unr.edu. Tian is from Lindner School of Business, University of Cincinnati; email: tiany2@mail.uc.edu. Yu is from Lindner School of Business, University of Cincinnati; email: tong.yu@uc.edu. Zhang is from Donlinks School of Economics and Management, University of Science and Technology Beijing; email: rzhang@ustb.edu.cn. We would like to thank Hui Guo, Clark Liu, Mark Wu and seminar participants at the 2019 China Finance Review International Conference and 2020 Financial Management Association Conference. All errors are our own.

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## Abstract

We propose a unified framework to model the effects of implicit government guarantees on bond value. Implicit guarantees improve the value of highly rated corporate bonds through lowering the default probability of such bonds, serving the role of solvency protection. Additionally, guarantees affect the value of poorly rated bonds through bailouts in default states. We evaluate the guarantee effect as the difference between yield spreads of a non-state-owned enterprise (non-SOE) bond and an SOE bond sharing similar attributes. Among newly issued corporate bonds, the average guarantee effect is 72 basis points (bps) for AAA rating bonds while it rises to 166 bps for AA- rating (the lowest rating at issuance) bonds. The guarantee effect for poorly rated bonds is even stronger in the secondary market, suggesting a substantial price advantage of SOE bonds. Finally, we provide evidence on the selective nature of the implicit guarantee; the guarantee effect is stronger among strategically important industry sectors, issuers from geographical regions of strong fiscal conditions, and low-leverage firms.



Keywords: Implicit government guarantee; Bond yield; Default risk; Bailout; Credit rating

# 1 Introduction

State-owned enterprises (SOEs), legal entities sponsored by the government, receive explicit and implicit government guarantees (IGGs) when they experience financial difficulties (see e.g., World Bank, 2014). Existing studies on IGGs predominantly focus on financial institutions (Lin and Tan, 1999; Lucas and McDonald, 2006; Baker and McArthur, 2009; Faccio, Masulis, and McConnell, 2006; Li, Qu, and Zhang, 2011; Panageas, 2010; Acharya, Anginer, and Warburton, 2016; Ueda and Mauro, 2013). Yet, the specific mechanism and the magnitude of IGG effects on corporate bonds issued by non-financial firms are unclear. The significant growth in the Chinese corporate bond market provides an opportunity to address these questions. In particular, China has the largest pool of SOEs in the world (Song, Storesletten, and Zilibotti, 2008; Zhou and Wang, 2000; Zhu, 2016).[1] In this paper, we explore the implicit government guarantee effects on corporate bonds using a large sample of Chinese corporate bonds issued by SOEs and non-SOE non-financial firms.

In a contingent claim setting, a risky bond can be viewed as a risk-free bond minus a default put option on the assets owned by the firm (Merton, 1974). The presence of government protection lowers the firm's chance to go default offsetting the implicit short put option value. Bonds issued by guaranteed firms therefore have higher values (lower yields) than those of non-guaranteed firms. Nevertheless, being an implicit and incomplete contract, an implicit guarantee does not provide full insurance to bondholders (Song, Storesletten, and Zilibotti, 2008; Liu, Lyu, and Yu, 2017). In other words, bondholders would not expect the government to fully protect them when the issuer is in a default state. We accordingly model the asymmetric effects of implicit guarantees as a combination of a full-insurance solvency protection and a partial-insurance bailout protection. The former is the main driver of government guarantees among high credit rating bonds while the latter could be a main force driving IGGs of low credit rating bonds. We address the relative magnitude of the solvency

[1] China had 51,000 SOEs holding asset values of USD 29.2 trillion and employing approximately 20.2 million people in 2017. This far exceeds the second largest SOE economy, Hungary, with 370 SOEs. In 2017, the aggregate market value of outstanding corporate debt in China was $19.7 trillion, which is 160% of its GDP. See Bank for International Settlements, Ang, Bai, and Zhou (2019), Jin, Wang, and Zhang (2018), and Livingston, Poon, and Zhou (2018).

protection premium and the partial bailout premium in the empirical examinations. Moreover, the model also shows that as government is constrained by protection lower bounds, the guarantee effect is expected to be lower for firms that have higher protection lower bounds.

Empirically, we first examine the presence of guarantee effect in the corporate bond sector by assessing the pricing of SOE and non-SOE bonds. Pooling all bonds together, we find that the average yield spread of SOE bonds is 101 bps lower than that of non-SOE bonds at issuance and the yield spread difference rises to 146 bps in the transaction sample. Next, we contrast SOE bonds with non-SOE bonds with a same credit rating. For the issuance sample, we find that the yield spread difference between an average AAA SOE bond and a non-SOE bond is 68 bps. The magnitude of differences in yield spreads is similar for other rating groups: 63 bps (AA+), 51 bps (AA) and 63 bps (AA-, the lowest possible issuance rating in China). Geng and Pan (2019) point out that credit quality of non-SOE issuers are higher than their SOE counterparts of the same rating category, and credit ratings of the former group better reflect corporate fundamentals. Consequently, the direct comparison of yields of SOE and non-SOE bonds of the same ratings does not fully reveal the impact of IGG on bond pricing.[2] As a remedy, we estimate an intrinsic rating of each SOE bond based on the credit rating of a matching non-SOE bond sharing similar attributes. When newly issued bonds are sorted on the intrinsic ratings, the yield spread differences across rating groups are no longer flat – 72 bps (AAA), 82 bps (AA+), 93 bps (AA) and 166 bps (AA-). Poorly rated SOE bonds receive more IGG protection than do highly rated corporate bonds. This is consistent with our model prediction that poorly rated bonds are likely to go bankruptcy thus the guarantee effect of such bonds involves a significant portion of bailout premium, greater than the solvency protection premium for highly rated bonds.

The dominance of the bailout premium is even stronger when we study the IGG effect in the secondary market. Sorting bonds by intrinsic ratings, we find that, among AAA (intrinsic rating) bonds, the yield spread difference between these two groups is 85 bps, which is not much different from that of the issuance sample. Astonishingly, the difference

[2]To see this, assume that an SOE bond is rated AAA but would be rated AA+ if it were a non-SOE bond. When we compare the yields of this bond with an AAA non-SOE bond, we would underestimate the IGG effect on bond yields because a wrong benchmark rating group is used.

for bonds with BB (intrinsic rating) and lower ratings is over 45%. Clearly, the bailout premium substantially inflates the price of non-investment grade SOE bonds.

Detailed in Section 3, the year of 2015 witnessed the first SOE default in China. The event clearly results in a higher rating standard on SOE bonds – as a result, the lowest credit rating is A before 2015 and D afterwards. This generates interesting testable implications on guarantee effects. On one hand, we expect a weaker guarantee effect when investors anticipate SOEs are less protected after the incidence (Jin, Wang, and Zhang, 2018). On the other hand, as implicit subsidies may be more needed by poorly rated bonds, we expect a stronger guarantee effect in years after 2015. Focusing on poorly rated SOE bonds, we find that the average guarantee effect is 1.61% in years before 2015 while it jumps to over 45% in and after 2015, which is supportive to the latter case.

Finally, we shed light on the selective nature of the implicit guarantee. While the majority of SOE bonds are well guarded, a subset of SOEs could be left under- or un-protected. We test how the guarantee effect is affected by the protection lower bound (measured by, e.g., whether an SOE is from a strategically important industry or a central or local government SOE). We find that, on average, the yield spread difference between SOE bonds and matching non-SOE bonds is 33 bps larger in strategically important sectors than other sectors at issuance. We also find that the guarantee effect of central government sponsored SOE (central SOE) issued bonds is 28 bps larger than that of local-SOE bonds. When using firm leverage to proxy for the lower protection bound, we find that a one-percent increase of leverage ratio leads to 1.43% decreases in the differences between SOE and non-SOE bonds at issuance. In sum, limited coverage from implicit guarantees appear to have multiple effects. It curbs the protection to highly leveraged firms while favors bonds from strategically important industries and central government sponsored SOEs.

This study makes several important contributions to the literature. First, our analysis is based on a large sample of corporate bonds issued by both SOE and non-SOE firms, which facilitates a systematic analysis on the effect of implicit guarantee on bonds issued by state owned enterprises. Our approach differs from existing works on implicit guarantee, such as Baker and McArthur (2009), Li, Qu, and Zhang (2011), Tsesmelidakis and Merton (2013), which mainly focus on the effect of government bailout of U.S. financial institutions in the 2008-09 financial crisis. Our approach also differs from Jin et al. (2018) which quantifies the value of implicit government guarantee using the abnormal bond returns of SOEs and non-SOEs around the first SOE default event. Second, our study examines the effect of IGGs on corporate bonds, different from existing works on local government financing vehicle (LGFV) debt, also known as Chengtou debt backed directly by local governments and indirectly by the central government (Ang, Bai, and Zhou, 2019). Consistent with Geng and Pan (2019), we find that the Chinese bond market is highly segmented in the sense that the pricing of SOE bonds differs from that of non-SOE bonds in a substantial way.

Second, we develop an option-based framework to unify two channels of guarantee effects – a solvency protection effect and an *incomplete* bailout effect. The former may be considered as the IGG effect on corporate default probability ($PD$) and the latter is the effect on bond losses given default ($LGD$). We demonstrate that the bailout premium is incredibly high among lowly rated SOE bonds while the solvency protection premium is awarded to SOE bonds with the highest credit ratings. The substantial gap between the yield spreads of SOE and non-SOE bonds, especially within poorly rated corporate bonds, raises concerns about the fairness and efficiency of the Chinese corporate bond markets. On one hand, SOEs dominate key sectors and have access to the financial market at a much cheaper funding cost, consistent with Davies and Tracey (2014) showing that implicit subsidies lead to a reduction in large banks' funding costs due to investor expectations of government support. However, lower competition and less exposure to insolvency risks (resulting in high leverage) potentially make SOEs inefficient, less productive, and more sensitive to systemic risk.

The remainder of the paper is organized as follows. Section 2 presents the theoretical framework on implicitly guaranteed bond pricing, followed by testable implications. In Section 3, we introduce the background of the Chinese corporate bond market, then discuss the data. Section 4 presents our empirical results. Section 5 concludes.

## 2 Model

Firms face substantial uncertainties in their future production and valuation. Implicit guarantees are a form of government subsidy available to some privileged bondholders when a firm experiences financial difficulty. In this section, we outline a model to integrate roles played by such implicit guarantees for the firm under different future states.

To begin, consider a non-guaranteed firm whose asset value, $v_t$, follows a *generalized Wiener process*. The firm's asset value under the physical measure $P$ is expressed as:

$$dv_t = (\xi_t + r_t)v_t dt + \sigma_v v_t dz_t^P \tag{1}$$

where $\xi_t$ is the asset risk premium at t; $r_t$ is the risk-free rate at time t; $z_t^P$ is a standard Brownian motion under the physical probability measure $P$.

$v_t$ can be equivalently expressed under the risk-neutral measure $Q$ as

$$dv_t = r_t v_t dt + \sigma_v v_t dz_t^Q \tag{2}$$

The firm issues a zero-coupon debt with a face value, $D$, for simplicity. The bond defaults when the asset value falls below $D$ at maturity date $T$. As we set 0 as the current time, $T$ also denotes the bond's time to maturity. Let $E_0[.]$ denote the expectation conditional on time 0 information under the $Q$ measure. Without implicit government guarantee, the value of the firm's debt at time 0 is $e^{-rT}E_0[min(v_T, D)]$, where $r$ is the continuously compounded annual risk-free rate of return and $T$ represents the time to maturity of the bond. A risky bond resembles the combined payoff of a risk-free debt and a short default put option with an exercise price, $D$.

Denoting the present value of the default put as $P_D$ and suppressing the subscript, $T$, we have

$$P_D = e^{-rT}E_0[max(D - v, 0)] \tag{3}$$

Shown in Figure 1[3], The IGG benefits guaranteed bondholders when $v < D$, i.e., when at $T$ the bond issuer is in default. Elaborated below, IGG either makes an originally insolvent firm stay solvent or bails out bondholders of an insolvent firm.

Considering the first case,

$$v < D \text{ and } v + \Delta v \geq D \tag{4}$$

Note that in the above expression, $\Delta v$ not only benefits bondholders, but also equityholders as the greatest benefit accrued to bondholders is $D - v$. $v + \Delta v - D$ goes to equityholders. When the guaranteed firm is insolvent, the benefit to equityholder goes to zero, i.e., $v + \Delta v^* - D = 0$. The entire benefit of government guarantees goes to bondholders.

$$\lambda \equiv \Delta v^* = D - v \tag{5}$$

Figure 1 shows that $\lambda$ is defined as the highest benefit that bondholders obtain from the guarantee. Using $G$ to denote the payoff of the guarantee to bondholders, we have

$$\begin{aligned} &G = 0 \quad (v > D) \\ &G = D - v \quad (D - \lambda \leq v \leq D) \end{aligned} \tag{6}$$

This is the solvency protection region depicted as points on the line DF of figure 1.

Next, we look into the second guarantee effect, the bailout effect, when $v < D - \lambda$, i.e., the firm is in default. At default bond investors do not expect to be paid fully. Shown in Figure 1, bond investors receive $D - \delta$ when $v$ falls below $D - \lambda$, where $\delta$ is a payment discount. In case a guaranteed firm is in a deep distress state, the government may walk

[3]Figure 1 demonstrates the IGG payoff under the probability measure $Q$. Based on Eq. (1) and Eq. (2), the value process under the probability measure $P$ is simply a linear transformation of the process under the probability measure $Q$, consistent with the equivalency of these two processes under the no-arbitrage condition.

away and let it default. The lower bound of the government protection is denoted as $K$ ($0 \leq K < D - \lambda$). Accordingly we have

$$\begin{aligned} &G = D - \delta - v \quad (K \leq v \leq D - \lambda) \\ &G = 0 \quad (v < K) \end{aligned} \tag{7}$$

We assume $\frac{\partial \delta}{\partial v} < 0$. That is, when $v < D - \lambda$, a lower $v$ is expected to associate with a greater discount in G. In other words, whether $v$ is below or above $D - \lambda$ makes a difference to $G$.

Combining Eq. (6) and Eq. (7), we express the value of the implicit government guarantee, $\pi$, as below:

$$\begin{aligned} \pi &= \underbrace{e^{-rT} \int_{D-\lambda}^{D} (D - v) f(v) dv}_{\text{solvency protection}} + \underbrace{e^{-rT} \int_{K}^{D-\lambda} (D - v - \delta) f(v) dv}_{\textit{bailout}} \\ &= \pi_s + \pi_b \end{aligned} \tag{8}$$

where $f(v)$ represents the risk neutral probability density function for $v$, $\pi_s$ is a solvency protection premium, and $\pi_b$ is a bailout premium.

Using $y_g$ and $y_n$ to denote yields of the guaranteed and non-guaranteed bonds, we have

$$\pi = D[e^{-y_g T} - e^{-y_n T}] \tag{9}$$

That is, an implicit guarantee can be priced as the difference in the discount value between a guaranteed bond and its corresponding non-guaranteed bond. Implicit government guarantees benefit bondholders, increasing bond value and lowering yields. Applying the first order approximations for $y_g$ and $y_n$ around the risk-free rate, $r$, we obtain a linear relation between $\pi$ and the yield difference between a non-guaranteed bond and a guaranteed bond, $y_n - y_g$, as follows.

$$\pi = e^{-rT}D(y_n - y_g)T \tag{10}$$

A rearrangement of $\pi$ leads to

$$y_n - y_g = \frac{\pi}{\alpha} \tag{11}$$

where $\alpha = e^{-rT}DT$. $\alpha$ is the present value of the dollar duration of the equivalent treasury bond selling at par value. This is related to our first proposition.

**Proposition 1** *The difference in yields between a non-guaranteed bond and a comparable guaranteed bond, $y_n - y_g$ is positively associated with the value of IGGs, $\pi$.*

Referring back to Eq. (8), we define $\pi$ as the sum of a solvency protection premium, $\pi_s$, and a bailout premium, $\pi_b$. The two components of $\pi$ may vary across individual bonds. Acting like an out-of-the-money put option, IGGs mainly offer a solvency protection to highly rated bonds with low credit risk. Alternatively, by bailing out poorly rated bonds in insolvency states, IGGs function like an in-the-money put option to substantially enhance bond value.

As shown in Appendix B1, $\pi_s$ can be rewritten as

$$\begin{aligned}\pi_s &= e^{-rT}\int_{D-\lambda}^{D}(D-v)f(v)dv \\ &= De^{-rT}N(-d_2) - v_0N(-d_1) - [De^{-rT}N(-d_4) - v_0N(-d_3)]\end{aligned} \tag{12}$$

where $d_1$ is $\frac{\ln(v_0/D)+(r+\frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$ and $d_2$ is $d_1 - \sigma\sqrt{T}$ under Black and Scholes (1973)'s setup. Similarly, $d_3$ is $\frac{\ln(v_0/(D-\lambda))+(r+\frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$ and $d_4$ is $d_3 - \sigma\sqrt{T}$. Note $v_0$ is the firm asset value at current time $t = 0$.

$$\pi_b = e^{-rT}[\int_{K}^{D-\lambda}(D-v)f(v)dv - \int_{K}^{D-\lambda}\delta f(v)dv] \tag{13}$$

$\pi_s$, the solvency premium, clearly decreases in $v_0$, the current asset value, which is proved in the Appendix B2. As $v_0$ of a given bond can be reflected in its rating. $\pi_s$ decreases in bond ratings. Put differently, highly rated bonds benefit less from the implicit guarantee.

Yet, the relationship between $\pi_b$, the bailout premium, and bond ratings is unclear. As shown in Appendix B2, there is an inverse relationship between the first component of $\pi_b$ and the current asset value, in $v_0$, suggesting $\pi_b$ to decrease in bond ratings. However, $\frac{\partial \delta}{\partial v} < 0$ suggests that a lower asset value leads to greater expected losses when the firm is in default. Poorly rated firms could benefit less from implicit guarantees.

We have the following proposition considering the discussion above:

**Proposition 2** *$\pi_s$ is the main driver of IGGs among high-rating bonds while $\pi_b$ is the main driver of IGGs among low-rating bonds. $\pi_s$ decreases in bond ratings while the relationship between $\pi_b$ and bond ratings is unclear.*

Owing to the presence of $\delta$, under Proposition 2, we are unclear about the relative magnitude of $\pi_b$ and $\pi_s$.

Finally, let us consider the effect of lower protection bound, $K$, below which the implicit guarantee no longer improves bond value. IGG equates the value of the default put option minus the expected value of the put option when firm value falls below $K$ minus the expected value of the discount in bailout.

$$\pi = e^{-rT}\int_0^D (D-v)f(v)dv - e^{-rT}\int_0^K (D-v)f(v)dv - e^{-rT}\int_K^{D-\lambda} \delta f(v)dv \tag{14}$$

where $\int_0^K (D-v)f(v)dv$ represents the partial value of the default put option when firm asset value falls below $K$. Its value is determined by $K$, driven by the market belief of the likelihood for the government to bail out the firm; such likelihood is higher when $K$ is low, and vice versa. In a polar case that $K = 0$ (the government fully guarantees the firm's default risk), the guarantee may make the risky debt issued by a guaranteed firm risk-free. We can derive IGGs to be inversely related to the lower protection boundary $K$. The formal proof is provided in Appendix B3.

**Proposition 3** *IGGs decrease in the protection lower bound,* K.

We do not explicitly consider the effect of the protection upper bound, $D$, for two reasons. First, $D$ has a mixed effect on $\pi$. It, on one hand, increases $\pi$ in the sense that a higher $D$ leads to a greater put option value. On the other hand, holding $\lambda$ constant, a higher $D$ exposes a bond to a higher likelihood of becoming insolvent (Opler and Titman, 1994). This potentially increases the lower protection bound, $K$, which lowers the value of IGGs. The second and more important consideration is that the default trigger of a coupon bond typically is not a firm's failure to pay face value. It is often a violation of minimum net worth or working-capital requirements (see e.g., Wruck, 1990). Consequently, $D$'s effect to improve the default put option value could be dominated by its influence of the protection lower bound, which is confirmed by our later empirical finding. Although it is possible to extend the model to allow the default trigger to be time-variant or to follow a separate stochastic process (Shleifer and Vishny, 1992; Longstaff and Schwartz, 1995), we take the current approach to keep the theoretic framework simple and intuitive.

# 3 Data

## 3.1 Overview of Chinese Corporate Bond Market

The corporate bond market in China mainly consists of three types of bonds: enterprise bonds, exchange-traded corporate bonds, and medium term notes.[4] Namely, the Chinese corporate bond market is segmented. Enterprise bonds are the earliest bonds issued by corporates with the main purpose of facilitating macroeconomic policies. Issuers of enterprise bonds are predominantly SOEs. Exchange-traded corporate bonds are issued by both publicly listed and non-listed firms since 2007. Enterprise bonds and exchange-traded corporate bonds are registered with the China Securities Regulatory Commission (CSRC) and traded at the Shanghai Stock Exchange, the Shenzhen Stock Exchange, and the National Equities Exchange and Quotations (NEEQ, the over-the-counter trading system), while enterprise

[4]Commercial papers are also classified as corporate debt securities (Livingston, Poon, and Zhou, 2018). They are different in terms of regulations, maturity terms, and trading venues (see e.g., Amstad and He, 2019; Chen, Chen, He, Liu, and Xie, 2019). We do not include them in the analysis because they are a term-financing tool with maturities no longer than 1 year.

bonds are regulated by the National Development and Reform Commission (NDRC, a powerful government agency overseeing SOEs reforms) and traded either at exchanges or in the inter-bank bond market. Finally, medium term notes are traded in the inter-bank market, and their maturities range from 1 year to 10 years. In the Panel A of Appendix A, we summarize three types of non-financial corporate bonds. The Bank for International Settlements reports that at the end of 2018, right after the United States, China had the second largest corporate bond market in the world.

Regulations in the corporate bond market evolve over time. In the 1990s and early 2000s, very few non-SOEs could issue corporate bonds because then the corporate bond market was deemed to be a financing device for SOEs. The corporate bond market became accessible to non-SOE firms after 2006. Shown in the Panel B of Appendix A, beginning from 2007, a set of referral and approval-based rules governed corporate bond issuance under CSRC (2007), where corporate bond issuers are required to obtain referrals from guarantors and issuance must be approved by regulators (Chen, Chen, He, Liu, and Xie, 2019). In addition, issuers shall comply with the financial conditions on past earnings and financial leverage. The referral requirement was abolished in 2015 (CSRC, 2015), indicating the end of the first stage. In the second stage, besides the minimum financial requirements (such as net assets, recent earnings, financial leverage and default history) on bond issuers, CSRC (2015) requires regulatory approval and an AAA rating for issuance to public investors. Otherwise, bonds can only be issued to the qualified investors.[5] To simplify the issuance procedure, the regulator only requires registration for issues to qualified investors. In the third stage, the revised Securities Law (CSRC, 2020) introduces a registration-based system for the public issuance of corporate bonds. The issuers file applications and register with the regulator. Under the new rule, both minimum financial requirements on bond issuers and regulatory approval are removed. The new rules are designed to offer non-SOE firms an easier access to the bond market.

Figure 2 shows the aggregate issuance amount and the number of bonds issued by Chinese

[5] Qualified investors refers to investors who have adequate abilities to identify and tolerate risks, are aware of and independently assume risks associated with investment in corporate bonds. For example, financial institutions including commercial banks, securities companies, fund management companies and insurance companies are considered as qualified investors.

enterprises from 2000 to 2019. In 2000, only two enterprise bonds were issued with a total face amount of 6 billion CNY. The corporate bond market was dominated by state-owned issuers in the early 2000s. In 2006, the first non-SOE bond was issued by CSC Financial Co. with a face amount of 1 billion CNY. While the market share of non-SOE bonds was relatively small, it has increased significantly over the last decade. The non-SOE bonds accounted for more than 20% of the market share with 621 issues and a total issuance amount of 723 billion CNY in 2016. In 2019, the annual number of issues was over 2,500. The aggregate issuance amount of corporate bonds has reached 2.9 trillion CNY, including 548 billion CNY enterprise bonds, 1.1 trillion CNY medium term notes (MTNs), and 1.28 trillion corporate bonds.

High profile bankruptcies have caught significant public attention since 2015. The Baoding Tianwei Co., a state-owned enterprise controlled by the central government of China, announced its default on interest payments in 2015 (Gough, 2015). This is the first default of bonds issued by a central government-backed company.[6] After the Tianwei default, several large SOEs have defaulted or restructured their debt. Corporate bond defaults surged in the subsequent years – there are 35 defaults in 2017 and 119 defaults in 2018, which gives rise to interesting implications on guarantee effects. First, as noted by S&P Global (2018), government supports to debt owed by SOEs are becoming more selective. Second, bailout premiums become much more relevant when corporate defaults are prevalent.

## 3.2 Sample

Our initial sample consists of 2,784 corporate bonds issued by 826 publicly listed firms from 2009 to 2019.[7] In the analysis, we use a sample of corporate bonds at the initial offering stage and an additional sample in the subsequent transaction. The issuance sample includes information on issuers, issue types, offering dates, offering prices, offering amounts, coupon

[6]In February 2015, Tianwei failed to make a 1 billion CNY principal medium term notes (MTNs). Subsequently in April 2015, Tianwei failed to make interest due on 1.5 billion CNY MTNs. The ratings were AA+ when the two notes were first issued in 2011. The ratings of both bonds were downgraded to A in July 2014 and further downgraded to BBB in December 2014. Prior to the default in 2015, the debt ratio was as high as 162% and the net income was -3.3 billion, -6.3 billion and -10.1 billion CNY in the past three years.

[7]Over the sample period, there are about 3,800 publicly listed firms.

rates, and issuance ratings from the Wind economic database.[8] We start with 2009 because the corporate bond market was very small prior to 2009.[9] We apply several data filters that exclude the following four types of bond issues: i) bond issues where the type of issuers (SOEs or non-SOEs) cannot be identified; ii) missing offering prices and yields; iii) missing credit ratings; and iv) issues with floating coupon rates. The cleaning procedure leads to a bond issuance sample including 2,628 bonds issued by 814 unique firms. Among them, 1,670 bonds are issued by 435 state-owned enterprises and 958 bonds are issued by 379 non-state-owned enterprises.

The secondary market transaction sample includes closing prices, trading volumes and yields to maturity of individual bonds at the daily level. We exclude observations with no transactions in a day as the price is estimated through matrix pricing. We have 237,054 daily transactions and 24,594 quarterly transactions of bonds. Financial data of bond issuers is also obtained from the Wind economic database.

## 3.3 Summary Statistics

Table 1 reports the sample descriptive statistics. First, we report the characteristics of bonds in the issuance sample. The yield spread is then defined as the difference between the bond yield and the associated yield of the treasury bond with the same maturity. The Treasury yield curve is obtained from the China Central Depository and Clearing (CCDC) database. Yield spreads range between 0.67% and 4.16% with a mean value of 2.13% and a standard deviation of 1.09%. The average treasury bond rate is 3.19% with a standard deviation of 0.45%. Coupon rates of sample bonds range from 3.4% to 7.50% with a mean value of 5.31%.

We breakdown bonds into 7 rating categories, including AAA, AA+, AA, AA-, A+, A,

[8]Different from corporate bonds issued by conventional businesses, a significant number of corporate bonds are issued by local government financial vehicles (LGFVs), to support urban infrastructure development. LGFV debt is mainly issued by private firms (Ang et al., 2019), thus our sample includes very few of such bonds.

[9]Note that the corporate bond market was dominated by state-owned issuers prior to 2009. The total issuance amount was 357 billion CNY in 2008. To minimize the impact of the global financial crisis on the economy, the Chinese government revealed an economic stimulus program and provided incentives for corporations to make investments with debt. As a result, the total annual issuance amount of corporate bonds was tripled and reached 1.14 trillion CNY in 2009.

A-, and BB or lower.[10] Despite the BBB- rating being commonly considered as the lowest investment grade rating in US., AA is viewed as the lowest rating for investment-grade bonds in China (Amstad and He, 2019). Consistent with this observation, the average credit rating of sample bonds has a numerical value of 6.15, corresponding to a rating score slightly better than AA+.[11] On bond maturity, the mean and median remaining maturities are 4.44 and 5 years, respectively, which are much shorter than U.S. bonds with the mean and median of 9.5 and 6.6 years, respectively.[12] The average (median) issue size is 1.44 (1.00) billion.

In our sample, 64% of sample bonds are issued by SOE firms and 17% of sample bonds are issued with an explicit guarantee. Noted in the background section, in the early years, explicit guarantees are required for bond issuance. Thus the use of explicit guarantees concentrates in early years.

At the secondary market, we find that the average (median) yield spread is 2.51% (1.93%) with a standard deviation of 3.63%. The value of credit ratings and remaining maturities is lower at the secondary market with an average (median) of 5.92 (6.00) than at the initial bond offering. As to firm characteristics, the average of total assets is 54.7 billion CNY, ranging from 3.4 billion to 245.5 billion. The average of long-term debt to assets (LTD/TA) and operating income to sales (Income/Sales) are 9% and 15%, respectively. The average of return on assets (ROA) and tangibility (net fixed assets/total assets) are 3% and 25%.

# 4 Empirical Results

In this section, we look into propositions outlined in Section 2. First, we examine the presence of guarantee effects for SOE bonds. Next, we study the magnitude of such guarantee effects in alternative bond rating groups. We decompose the guarantee effects to a solvency protection effect and a risky bailout effect, deemed to vary across credit rating groups. Finally, we investigate how the protection lower bound affects the value of implicit guarantees.

[10] Fewer than 0.5% of the sample bonds receive BB rating or lower with D as the lowest rating in our sample. We therefore consider all bonds with ratings of BB or lower as one single rating group.

[11] We follow the following conversion scheme: AAA = 7, AA+ = 6, AA = 5, AA- = 4, A = 3, BBB = 2, BB and lower = 1.

[12] U.S. corporate bond data from 2002 to 2019 is from Fixed Income Securities Database (FISD).

## 4.1 Yield Spreads of SOE Bonds versus Non-SOE Bonds

We first compare yield spreads of bonds issued by SOE firms and those issued by non-SOE (hereafter abbreviated as NSOE) firms. Separately for the issuance and transaction samples, yield spreads of SOE and NSOE firms are reported in different rows in Panel A, Table 2. We find that the average yield spread of bonds issued by SOEs is 101 bps lower than that of NSOEs at the issuance stage. The difference is even greater using the bond transaction sample where the average yield spread of bonds issued by SOE firms is 146 bps lower than that of NSOEs, consistent with Proposition 1.

Bond issuers from strategically important industries (hereafter abbreviated as SIIs), such as oil and gas, petrochemical, medical, power, transportation and utility sectors, could receive favorable treatment from the government. For this consideration, we anticipate bonds of SII issuers also benefit from government guarantees. As shown in different columns of Panel A of Table 2, on average, yield spreads of bonds issued by SIIs are significantly lower than those of non-SII bonds. The differences are 0.41% (t-stat = -4.05) at issuance and 0.37% (t-stat = -3.38) in transactions, much lower than the difference of yield spreads between SOE and NSOE bonds. Double sorting the sample by government ownership and strategically important industry, we find that the average yield spread of SII NSOE bonds in the transaction sample (362 bps) is higher than that of bonds issued by NSOE firms from non-SII sectors (338 bps), which is inconsistent with the expectation that SII firms are treated favorably. Conversely, within bonds issued by SOE firms, SII bonds have lower yield spreads (177 bps) than non-SII bonds (212 bps). We further explore the role of strategically important industries among SOE firms in Section 4.4.1.

Concerning that the portfolio analysis reported in Panel A ignores rating classifications, reported in Panel B, we perform regressions including bond ratings to examine how corporate ownership and industrial strategically importance affect bond yields. In the issuance sample, there are four rating categories varying from AAA to AA-, while in the transaction sample, we have seven rating categories ranging from AAA to BB or even worse. Consistent with Panel A, the reported coefficients on *SOE* are -0.61 and -0.84 in the issuance and transaction samples, respectively, significant at 1% level. In Columns (2) and (4), we further examine the industry effect on bond yield spreads. In the issuance sample, the coefficients on *SII* is -0.11, significant at 10% level, while the coefficient is insignificant in the transaction sample. Next, when we include both *SOE* and *SII* in the regression, the coefficients on *SOE* remain significantly negative, but the coefficients on *SII* are insignificant for both offering and trading samples. These findings confirm our conjecture that bonds issued by SOE firms are more likely to be favorably treated by the government and receive government subsidy. Instead, SII firms are generally treated similar as non-SII firms with no significant difference in terms of yield spreads.

Figure 3 plots the average yield spreads of SOE and NSOE bonds over time. Clearly, the yield spreads of NSOE bonds are higher than those of SOE bonds in every sample year, as proposed in Proposition 1. Noted in the background section, the first Chinese corporate bond default occurred in 2015, signifying the presence of credit risk. The figure suggests that the differences in yield spreads between SOE and NSOE bonds were higher in 2015 and afterwards than in early sample years. Geng and Pan (2019) report a consistent pattern.

## 4.2 Observed Rating Versus Intrinsic Rating

### 4.2.1 Rating Enhancement

Government support for SOEs has long been a major credit consideration for lenders. Ueda and Mauro (2013) report that financial institutions receive credit rating bonuses from credit rating agencies in the sense that the value of implicit government guarantees is embedded in credit ratings. Davies and Tracey (2014) employ "ratings uplift" for banks, defined as the difference between the support rating and the stand-alone rating, to estimate the implicit guarantees from the government. Consistently, credit rating agencies tend to inflate credit ratings of SOE bonds since external government support improves firm value and lowers credit risk. As depicted in Figure 5, about 60% of SOE bonds (994 issues) receive an AAA rating while only 24% of NSOE bonds (229 issues) receive an AAA rating when bonds are initially issued. Moreover, about 22% of SOE bonds receive AA+ (374 issues) and 17% of SOE bonds receive AA (285 issues), while only 1% have AA- rating (17 issues). On the other hand, a large portion of NSOE bonds receive AA+ and AA ratings at the offering stage, 27.3% (262 issues) and 45% (431 issues), respectively. To summarize, we find that SOE bonds, on average, receive better credit ratings than NSOE bonds.

We perform ordered logistic regressions to ascertain the association between bond credit ratings and the firm's ownership status. Following Wooldridge (2010), using $F$ to denote the normal cumulative density function we set up the following probability estimation equation for the numerical credit rating of bond $i$ to receive a rating $x$, where $l < x < 7$ with $l$ as the minimum rating of a sample. For the issuance sample, $l$ is 4 corresponding to AA- and it is 1 for the transaction sample corresponding to BB.

$$\begin{aligned} Prob(Rating_{it} = x) = F(\beta SOE_{it} + \gamma Control_{it} \leq cut_x) \\ - F(\beta SOE_{it} + \gamma Control_{it} \leq cut_{x-1}) \end{aligned} \tag{15}$$

$$Prob(Rating_{it} = l) = F(\beta SOE_{it} + \gamma Control_{it} \leq cut_l)$$

$$Prob(Rating_{it} = 7) = 1 - F(\beta SOE_{it} + \gamma Control_{it} \leq cut_6)$$

Since the dependent variable of the ordered logistic regression is the categorical bond rating, we estimate the cutoff values, *cut*, for each rating. To be specific, for a given rating $x$, we estimate $cut_{x-1}$ and $cut_x$ as the lower and upper bounds of characteristic value for such a rating. For the two extreme rating groups, $cut_6$ is the lower bound for the top rating category and $cut_l$ is the upper bound for the lowest rating category.

Besides *SOE*, we include both issuer and issue characteristics as control variables of the logistic regression. Following prior research on the determinants of corporate bond ratings (Altman, 1968; Kaplan and Urwitz, 1979; Ziebart and Reiter, 1992; Collin-Dufresn, Goldstein, and Martin, 2001; Campbell and Taksler, 2003; Ashbaugh-Skaife and LaFond, 2006), issuer characteristics include long-term debt to asset (*LTDA*) and operating income to sales (*OIS*), two important proxies for default risk – higher *LTDA* and lower *OIS* reflect greater default risk. Asset tangibility (*TANG*) is constructed as the ratio of the firm's property, plant and equity to total assets. Firms with lower *TANG* reduce the amount that they can pledge as collateral. Therefore, lower asset tangibility can make firms more risky as they are more sensitive to adverse shocks such as credit crunches and recessions. In addition, *Firm Size*, the natural logarithm of total assets, is included as a control variable. It reflects a firm's ability to handle default risk. Large firms face lower credit risk and are expected to have higher credit ratings. Issue characteristics include *Maturity* (bond remaining maturities in years), *Issue Size* (the logarithm of bond issue amount), and *Explicit Guarantee* (an indicator equal to one when a bond has an explicit guarantee at issuance and zero otherwise). Longer *Maturity* bonds are expected to have greater exposure to interest rate risk and credit risk. *Issue Size* is expected to be negatively related to the credit risk of issuers in the sense that Larger issuances are more likely to be issued by large firms with greater liquidity. Explicit guarantee is a categorical variable that equals 1 if the bond has a guarantor. Guarantors provide external support if the issuer has trouble making interest and principal payments (see e.g., Jin, Wang, and Zhang, 2018).

Regression results are reported in Table 3. Respectively, we use bond ratings at issuance (Columns 1 and 2) and ratings in the course of transactions (Columns 3 and 4) as dependent variables. To be specific, we solely include issuer characteristics in the logistic regressions reported in Columns (1) and (3) and include both issuer and issue characteristics in regressions reported in Columns (2) and (4). As reported in the first column, we find the coefficient on *SOE* is 1.18 with t-statistics of 11.57. In addition, $cut_4$, the upper bound of the characteristic value for AA bonds, is 27.94 and $cut_6$, the lower bound of the characteristic value for AAA bond, is 34.19. The difference of 6.25 is for two notch distance between $cut_4$ and $cut_6$ – stepping up one notch in the credit rating requires 3.125 (6.25/2) of an additional combined score increase. As a result, when the SOE indicator is the only factor that changes, the credit rating is increased by 0.38 (=1.18/3.125) notches on average. This means, under a linear transformation between issuer characteristic values and bond ratings, the average rating of an SOE bond is 0.38 notches higher than that of a NSOE bond with similar issuer characteristics. The finding reported in Column (2) is consistent when both issuer and issue characteristics are used in the logistic regression.

Applying the transaction sample, we find a stronger SOE effect on bond ratings. Reported in Column (3), the SOE status indicates an increase of 0.55 (=1.13/2.04) notches in bond ratings when issuer characteristics are included in the regression.[13] It should be noted that the SOE effect may be larger at a lower rating level. To see this, as reported in Column 3; moving from $cut_5$ to $cut_6$ requires a step of 2.08, whereas moving up from $cut_1$ to $cut_2$ requires a step of 0.61. This means it is easier for SOE bonds to achieve an enhanced rating in poor-rating groups than high-rating groups. Column (4) which reports the regression results pooling together issuer and issue characteristics reveals consistent results. Taken together, Table 3 confirms the conjecture that state ownership helps to improve bond credit ratings.

#### 4.2.2 Propensity Matching and Intrinsic Ratings

The inflated ratings of SOE bonds could bias guarantee effects estimated as the difference in yield spreads between SOE and NSOE bonds downward. Intuitively, an improvement in an SOE bond's rating leads to a higher rating of its benchmark group, resulting in an under-estimation of IGG benefit. We address this problem by estimating intrinsic ratings of individual bonds, i.e., stand-alone ratings of SOE bonds without implicit government guarantees. To do so, for an SOE bond, we adopt a two-step approach to pair up NSOE bonds with similar issuer and bond characteristics (Rosenbaum and Rubin, 1983; Faulkender and Yang, 2010).[14] In the first step, using a propensity score matching (PSM) , we perform a firm-level logistic regression which matches issuers' propensity scores:

$$Prob(SOE = 1) = F(\alpha_1 LTDA_{it} + \alpha_2 OIS_{it} + \alpha_3 TA_{it} + \alpha_4 TANG_{it} + \mu_j + \tau_t) \qquad (16)$$

The propensity of becoming an SOE is estimated based on the same issuer characteristics used in the rating regression, ie., Eq. (15) – long-term debt to asset (*LTDA*), operating income to sales (*OIS*), the firm's total assets (*TA*), and tangibility (*TANG*). We expect firms with similar credit risk to share similar propensity scores. Consistent with other

[13]The difference between $cut_1$ and $cut_6$ is 10.2. Given the distance between $cut_1$ and $cut_6$ is 5 notches, an increase of one notch credit rating requires about 2.04 of an additional combined score.

[14]Firm ownership selections could be separate from bond attribute choices, which justifies the two-step analysis. We find consistent results when performing the match by considering issue and issuer characteristics in one regression.

works, e.g., Geng and Pan (2019), we include the industry fixed effect, $\mu_j$ ($j$ represents the jth industry for firm $i$) using the 17 industries classification from the China Securities Regulatory Commission (CSRC)[15], and the time fixed effect, $\tau_t$.

Then in the second step, we further conduct a matching of bond characteristics. For an SOE with multiple bond issues, we further match SOE bonds using the term of years to maturity. Bonds are further are classified into three categories based on their maturities: short term (1-3 years), medium term (4-7 years), and long term (7 years or longer). We estimate the intrinsic rating of an SOE bond as the average credit rating of matching NSOE bonds. In case that the credit rating of the matching peers is lower than the observed rating, we consider that observed ratings are inflated by rating agencies. For bonds which cannot be matched with similar firm and bond characteristics based on the matching criteria, we assume the observed rating reflects its intrinsic rating.

We present the result of the propensity score matching analysis in Panel A of Table 4. For each SOE firm, we identify the NSOE firms that has the closest (in absolute terms) propensity score. We also require that the matching firm is within the same industry and quarter. So for each SOE firm, this approach identifies a best-matched NSOE peer. We find that SOE firms have significantly larger size in assets and higher tangibility, while they have lower long-term debt to assets and operating income to sales ratios.

Panel B of Table 4 summarizes selected financial data for SOEs and matching NSOEs. The table gives the means of long-term debt to assets, operating income to sales, firm size (logarithm of total assets), and tangibility (net fixed assets to total assets) in the offering and trading samples. In the offering sample, SOEs have similar long-term debt and operating income ratios as NSOEs and the differences are insignificant. Despite matching the companies on the closest propensity score based on those four variables, SOEs have a larger firm size and lower tangibility ratio than NSOEs. The empirical finding suggests that SOEs are similar as matching NSOEs based on the selected firm characteristics.

In the Appendix Table 1, we demonstrate the rating migration from intrinsic ratings to

[15]These industries consist of agriculture, mining and steel, manufacturing, utility, construction, retail and wholesale, transportation/storage/postal, hotels and restaurants, IT, financial, real estate, rental and commercial services, environmental and public facilities, residential services, health and community services, entertainment, and others.

inflated (observed) ratings. In Panel A, we perform the analysis using the issuance sample. As reported in the first row, 173 AA+ bonds, 134 AA bonds and 10 AA- bonds are inflated to AAA ratings; reported in the second row, 111 bonds, including 108 AA and 3 AA- bonds, are inflated to AA+ ratings; in the third row, 16 AA- bonds are inflated to AA ratings. In a similar pattern, Panel B reports the rating migration using the transaction sample. The first row of Panel B shows 1,404 AA+ bonds, 1,544 AA bonds, 169 AA-, 93 A bonds, and a few BBB or lower rating bonds are inflated to an AAA rating. In general, reported values above the diagonal of Panel A and B are much higher than those under diagonal, indicating that SOE bonds have more inflated ratings than deflated ratings.

## 4.3 Solvency Protection versus Risky Bailout

According to Proposition 2, implicit guarantees affect bond yields in two ways. The first is a solvency protection which makes highly rated SOE bonds less likely to default than similar NSOE bonds. The second is a bailout protection to poorly rated SOE bonds by bailing them out when they are in a default stage. Recognizing that IGGs build on investors' expectations, rather than realizations, a direct testable implication is that highly rated SOE bonds benefit more from solvency protection while the bailout protects poorly rated bonds more. To test this, we sort the sample by credit ratings, both observed ratings and intrinsic ratings derived in the last subsection, to examine IGG effects measured as the difference in yield spreads between SOE and NSOE bonds. The results are reported in Table 5.

The bond offering sample involves four credit ratings: AAA, AA+, AA, and AA-. In Panel A under the caption "Observed Rating", we report that the yield spread differences between SOE and NSOE bonds by observed ratings are -0.68% (AAA bonds), -0.63% (AA+), -0.51% (AA), and -0.63% (AA-), respectively. IGGs lower SOE bond yields in all ratings.

As shown in Panel B, more rating groups are involved in the transaction sample which range from BB (and lower) to AAA. We report the difference in yield spreads between SOE and NSOE bonds in different rating groups. The average difference is -0.79% for AAA bonds. Average yield spreads for BBB bonds and BB (and lower rated) bonds are -2.84% and -38.90% respectively, but neither of them is statistically significant. There are very few

SOE bonds in these two rating groups, merely one in the BBB group and two in the group containing BB and lower rated bonds, which leads to insignificant differences in these two groups.

We additionally sort bonds based on intrinsic ratings. We see a substantial increase in the number of low rating SOE bonds. For example, in the issuance sample, the number of AA- rating bonds increases from 17 to 46. Consistent with our expectation, the yield spread difference becomes larger based on intrinsic ratings, from 72 bps for AAA bonds to 166 bps for AA- bonds. The larger IGG effect on lower rated bonds suggests that a stronger IGG effect is attributed to the bailout protection.

We further examine the two components of IGG effect, i.e. solvency protection effect and bailout effect, in a regression setting controlling for a series of variables, including the industry and quarter fixed effects. The regression model is specified as follows:

$$YS_{it} = \beta_1 SOE_{it} + \beta_2 Rating_{it} + \beta_3 Rating_{it} * SOE_{it} + \gamma Control_{it} + \mu_j + \tau_t + \epsilon_{it} \quad (17)$$

where $YS_{it}$ is the yield spread of bond $i$ and $SOE_{it}$ is the indicator for government ownership. The coefficient on the SOE indicator captures the IGG effect on yield spread difference between SOE bonds and the matching NSOE bonds. According to Proposition 2, we anticipate solvency protection benefits highly rated bonds more while the bailout protects poorly rated bonds more. To capture the guarantee effect in different rating groups, we include interactions between the SOE dummy and different rating dummies. Note that here we use intrinsic ratings rather than observed ratings because the former could better capture the default risk of SOE bonds. To be specific, three intrinsic rating dummies (AA+, AA, and AA-) are included in the regression for the issuance sample while the AAA rating group is used as a benchmark. We additionally include the dummies for A, BBB, BB and below in the regression for the transaction sample.

In Eq. (17), $Control_{it}$ represents a vector of bond and firm characteristics used in the literature (Collin-Dufresn, Goldstein, and Martin, 2001; Chen, Lesmond, and Wei, 2007; Huang and Huang, 2012). The included firm characteristics are i) long-term debt to assets,

ii) natural logarithm of firm size, and iii) operating income to sales. The included bond characteristics are i) bond maturity, ii) the natural logarithm of issuance amount, iii) the explicit guarantee indicator. We also include the Amihud illiquidity measure (Amihud, 2002; Schestag, Schuster, and Uhrig-Homburg, 2016) as a control variable concerning that prior works (e.g., Collin-Dufresn, Goldstein, and Martin, 2001; Huang and Huang, 2012) show bond illiquidity is an important bond yield determinant.[16]

The regression results are presented in Table 6. Shown in Column 1, the coefficient on *SOE* is -0.51 with a t-statistic of -8.22, implying a 51 bps yield spread reduction for SOE bonds compared to NSOE bonds in the issuance sample, consistent with Table 2. The coefficient on AA+ is 0.65 with a t-statistic of 8.28, showing that, at issuance, the average yield spread of NSOE AA+ bonds is 65 bps higher than the benchmark group (AAA bonds). The coefficient on AA is 0.96, significant at the 1% level, indicating that the average issuance yield spread of NSOE AA bonds is 96 bps higher than the benchmark group. Most strikingly, the coefficient on AA-, the lowest rating at issuance, is 2.07, significant at the 1% level, showing a much larger yield premium (207 bps) for NSOE AA- bonds than the benchmark group.

On the heterogeneous guarantee effects across ratings, we find the coefficient on the interaction term between SOE and AA+ is -0.34, significant at the 1% level, suggesting that IGGs lead to an additional 34 bps yield reduction for SOE AA+ bonds when comparing with similar NSOE bonds. Notably, the additional yield reduction from IGGs goes to -113 bps for SOE AA- bonds, significant at the 1% level. Consistent with Proposition 2, we document a stronger guarantee effect on poorly rate bonds (mainly driven by the bailout) than highly rate bonds (mainly driven by the solvency protection). It is also worth noting that the adjusted R-square is 52.4%, suggesting that more than half of the variation of the yield spreads can be explained by the regression model.

The second column of Table 6 reports the results of the transaction sample. The reported coefficient on *SOE* is -0.53, which is significant at the 1% level, showing that, in transactions,

[16]We also apply other liquidity measures, including Roll's (Richard, 1984) and zero returns (Lesmond, Ogden, and Trzcinka, 1999) measures. Such alternative measures do not change our results substantially. For simplicity of purpose, we only keep results with Amihud measure.

the yield spread of SOE bonds on average is 53 bps lower than NSOE bonds. Like the findings from the issuance sample, poorly rated NSOE bonds generally have remarkably higher yield spreads than highly rated bonds. For instance, the coefficient on AA+ is 0.78 while the coefficient on BB and worse is as large as 43.98, significant at the 1% level.

The analysis on the transaction sample further reveals a substantial yield cut for SOE bonds when intrinsic ratings move from AA+ down to BB and worse. The reported coefficient on the interaction between SOE and AA+ bonds is -0.59, significant at 1% level, implying a 59 bps yield reduction from IGGs on SOE AA+ bonds. Astonishingly, The reported coefficient on *SOE*BB and lower* is -42.15, significant at the 1% level, suggesting the yield cut reaches 42% for SOE bonds with a BB or lower rating. The finding suggests a much stronger bailout effect for poorly rated bonds than the solvency protection effect on highly rated bonds.

Moreover, as discussed in the background section, the first SOE default of Baoding Tianwei Co. in 2015 presents us a unique setting to compare the relative magnitudes of the solvency protection effect and the bailout effect. As the first SOE default smashes investor expectations that SOE bonds could be fully protected by the government, to poorly rated bonds this event lowers the probability of solvency protection while increases the probability of risky bailout. Reported in Table 7, we examine the guarantee effect around 2015. Using a five-year window, we divide the sample into two periods: 2010-2014 and 2015-2019. We find that IGG effects are substantially higher in the period of 2015-2019. For example, IGG effect of the lowest rating (BB) bond rises to over 45% since 2015, while the IGG effect of the lowest rating (A) bond before 2015 is just 1.61%. In sum, our findings confirm the assertion that the bailout effect is greater than the solvency protection effect.

To summarize, our findings indicate that, on average, yield spreads of SOE bonds are lower than those of NSOE bonds, consistent with the view that government guarantees lower SOE firms' financing costs. Specifically, we find the IGG effect is stronger in the secondary market, and we also find a stronger bailout effect after the first SOE default in China.

## 4.4 Effects of Protection Lower Bound

In this section, we perform empirical examinations on Proposition 3 – the effect of the protection lower bound on the value of government guarantees. Since the protection lower bound is not directly observed, we measure $K$ using four proxies indicating investors' perception about how much government protection a firm may receive, including i) whether a firm is in a strategically important industry, ii) whether it is a local government SOE or central government SOE, iii) fiscal status of the local government for a local government SOE, and iv) the firm leverage level. $K$ is expected to play a big role when expected default rate of a firm is high. Similar to Bhanot and Larsson (2018), a recent paper investigating how regulatory uncertainty (the probability of not honoring a protection) affects credit spreads of covered bonds issued by Washington Mutual and Bank of America, we test how investors impound the protection lower bound into corporate bond pricing.

For ease of presentation, we define $IGG$ as the difference between yield spreads ($YS$) of a NSOE bond and an SOE bond with matching characteristics.

$$IGG_{it} = YS_{it}^{N} - YS_{it}^{S} \tag{18}$$

### 4.4.1 Potential Industry Effects

First, we examine the lower protection bound effect on IGGs by conducting regressions across industries. In case that the government protection is limited, the support to SOEs is selective and potentially leans toward sectors that are more strategically important. To verify this viewpoint, we perform an industry analysis and investigate the heterogeneity of the guarantee effects across industries. We break down the sample into four industry groups based on the WIND industry classifications: i) strategic (oil and gas, petrochemical, medical, power, transportation and utility sectors), ii) overcapacity (mining, steel, real estate and construction), iii) commercial services (retail, wholesale, hotel, restaurant and entertainments), and iv) others. Clearly, the first "strategic" sector is considered to be strategically important and receive greater support from the government than the other sectors.

To test this, we project $IGG$ onto respective industry indicators,

$$IGG_{it} = \beta Industry_{it} + \gamma Control_{it} + \mu_j + \tau_t + \epsilon_{it} \tag{19}$$

Control variables are firm characteristics including operating income to sales ratio and firm size as well as bond characteristics including Amihud illiquidity measure, and explicit guarantee measure. At the cost of over-controlling, we keep the industry dummies in the regression. The result is consistent with what we report below after removing the industry effect $\mu_j$

The empirical results, reporting coefficients on individual industry group dummies (*Strategic*, *Overcapacity*, *Commercial* and *Others*), are presented in Table 8. The coefficients on *Strategic* are significantly positive – $\beta$ equals 0.33 with a t-statistic of 3.25 using the offering sample and $\beta$ equals 0.22 with a t-statistics of 2.32 using the transaction sample, which suggests that the IGG effect in the strategic sector is 33 bps larger than that in other sectors during offerings (transactions). In contrast, the coefficients on *Overcapacity*, *Commercial*, and *Others* are not statistically significant. Our findings are consistent with Geng and Pan (2019) that the Chinese bond market is highly segmented – the differentiation in the pricing of SOE bonds and NSOE bonds is substantial. While Geng and Pan (2019) investigate such segmentation between SOE bonds and NSOE bonds that occurs for both public firms and private firms, we further identify an additional layer of segmentation within public firms – the protections differ across industrial sectors. It shall be noted that such a segmentation may hurt the growth of NSOEs and threaten the market stability. As SOEs in strategic important industries can get preferential access to bank loans and greater outside support from the government. In order to get financing help, NSOEs need to compensate for their lack of outside government support by providing an attractive balance sheet and window dressing corporate performance. Nonetheless, keeping a profitable and attractive balance sheet is unsustainable for NSOEs especially during stressful market conditions. From this perspective, such segmentation may potentially harm the fundamentals of the NSOEs.

Moreover, we find that the significant positive coefficients on intrinsic ratings suggest that SOE firms with a lower intrinsic rating (relative to AAA) have a larger IGG effect.

So, they benefit more from the government's support. Specifically, SOE firms with AA+ intrinsic ratings have 78 bps (134 bps) larger IGG effect compared to AAA bonds in the offering sample (trading sample). SOE firms with lower intrinsic ratings, such as AA and AA-, have 146 bps (200 bps) and 286 bps (216 bps) larger IGG effect, respectively, in the offering sample (trading sample). We find more striking results in the secondary market, which involves more rating groups than the primary market. SOE firms with a BBB (BB and worse) intrinsic rating have 1,969 bps (3,588 bps) larger IGG effect than AAA bonds in the trading sample. Obviously, poorly rated bonds are likely to go bankrupt and thus the IGG effect of such bonds involves a significant portion of bailout premium, which is greater than the solvency protection premium for highly rated bonds.

Related to other control variables, we find that a one percent increase in operating income to sales leads to a 105 bps (77 bps) larger IGG effect in the offering sample (trading sample). A one percent increase in firm's size generates a 32 bps (7 bps) larger IGG effect in the offering sample (trading sample). The coefficients on *Illiquidity* and *Explicit Guarantee* are insignificant. The results show that more profitable SOE firms and larger SOE firms benefit more from the IGGs.

### 4.4.2 Central versus Local Government Protection

Next, we examine how the governments' financial strength affects their protection of SOEs. Naturally, SOEs sponsored by central government are expected to receive more support than those sponsored by local government. Using *Central* to denote the indicator for central government sponsored SOEs, we test the conjecture using the following regression:

$$IGG_{it} = \beta Central_{it} + \gamma Control_{it} + \mu_j + \tau_t + \epsilon_{it} \tag{20}$$

Then, within local-government sponsored SOEs, we expect a higher ratio of provincial government revenue to expenses or a higher ratio of provincial GDP indicates a better government fiscal condition. We perform the following regression:

$$IGG_{it} = \beta Fiscal_{it} + \gamma Control_{it} + \mu_j + \tau_t + \epsilon_{it} \tag{21}$$

Table 9 reports the effect of government fiscal conditions on the IGGs. Reported in Columns 1 and 4, the coefficients on *Central* are 0.28 (t-stat = 2.72) and 0.27 (t-stat = 5.18) respectively for offering and trading samples, confirming that central government sponsored SOEs (hereafter abbreviated as CSOEs) receive greater government support than local SOEs (hereafter abbreviated as LSOEs) do. On average, CSOEs have a 28 bps (27 bps) larger IGG effect than LSOEs in offering (trading) sample.

Next, in Columns 2 and 3 (for the offering sample) and Columns 5 and 6 (for the transaction sample), we test the effects of the local fiscal condition. The coefficients on revenue to expense ratio are positive and significant at the 1% level. A one percent increase of local revenue to expense ratio leads to a 1.62% (1.29%) increase of IGG effect in offering (trading) sample. Regarding the local GDP, Columns 3 and 6 show that local GDP matters in the secondary market. A one percent increase of local GDP portion indicates a 3.73% increase of IGG effect in the secondary market. We also control for firm characteristics as in Table 6. Consistent with Table 6, more profitable and larger SOEs have larger IGG effects. Overall, our findings show that IGG effects are stronger for firms from regions of strong fiscal conditions, and SOEs sponsored by central government receive more support than do local SOEs.

### 4.4.3 Is There a Leverage Effect?

Lastly, we examine whether the leverage of individual firms affects the value of implicit guarantees. Different from other tables treating leverage as a control variable, leverage here becomes the variable of our interest, which is used as a proxy for the protection lower bound considering highly leveraged companies typically have greater credit risk exposure. Supportive to this argument, in the first SOE bond default case of the Baoding Tianwei Co., its book leverage ratio prior to the default is as high as 162.2%.

The following panel regression is performed:

$$IGG_{it} = \beta LEV_{it} + \gamma Control_{it} + \mu_j + \tau_t + \epsilon_{it} \tag{22}$$

where firm leverage, *LEV*, is proxied in two ways in Table 10. First, denoted as *Leverage*, it is measured as the total debt to the sum of total debt and book value of equity. Second, it is proxied by *High leverage*, a dummy variable that equals to 1 when *Leverage* exceeds 0.5 and zero otherwise.

Shown in Table 10, the coefficients on *Leverage* (*High leverage* indicator) are -1.43 (-0.85) and -1.36 (-0.68), respectively, in the issuance sample and transaction sample, significant at 1% level, indicating that a one percent increase of the leverage ratio leads to a 1.43% (1.36%) decrease in the IGG effect during offerings (transactions), controlling for firm characteristics and bond characteristics. Namely, a rise in a firm's protection lower bound decreases the IGG effect. Consistent with Table 6 and Table 8, the coefficients on intrinsic ratings are significantly positive, in both issuance and transaction samples, suggesting that SOE firms with lower intrinsic ratings (relative to AAA) have a greater guarantee effect. Specifically, SOE firms with AA+ intrinsic ratings have 83 bps (134 bps) larger IGG effect compared to AAA bonds in the offering sample (trading sample). SOE firms with lower intrinsic ratings, such as AA and AA-, have 154 bps (197 bps) and 300 bps (213 bps) larger IGG effects, respectively, in the offering sample (trading sample). The IGG effects are more noticeable in the secondary market, in which SOE firms with a BBB (BB and worse) intrinsic rating have 1,962 bps (3,529 bps) larger IGG effects than AAA bonds. Again, poorly rated bond are more likely to go bankrupt and thus benefit more from the government guarantees.

Also, more profitable and larger SOE firms are associated with greater guarantee effect. As shown in Column 2 and 3, a one percent increase of operating income ratio indicates a 64 bps larger IGG effect, significant at 5% level; a one percent increase of firm size leads to a 32 bps larger IGG effect, significant at 1% level, indicating the government leans more supports towards more profitable and larger firms. Overall, our findings show that a rise in individual firm's leverage, the proxy for the protection lower bound, leads to a lower guarantee effect, confirming the Proposition 3. Intuitively, firms with a high leverage typically have higher credit risk exposure and they are more likely to fall in a deep distress state, in which the government may walk away and let them default.

# 5 Conclusions and Discussions

Despite that it is well known that governments offer protections to state-owned enterprises, the specific channel for such protections affecting bondholders of SOE firms is unknown. Taking advantage of the large and fast-growing corporate bond market in China, this study fills in the gap by offering a theoretical framework and some empirical evidence on the effect of IGGs on bond pricing. In our model, we show that IGGs are viewed as an incomplete put option that alleviates SOE firms' default risks, and hence bonds of SOE firms are expected to have higher value (lower yields) than those issued by NSOE firms.

Implicit government guarantees are comprised of two elements – the solvency protection premium and the bailout premium. The former is the main driver of IGGs among highly rated bonds while the latter could be essential to poorly rated bonds. Poorly rated bonds are likely to go bankrupt so the IGG effect of such bonds involves a significant portion of bailout premium, greater than the solvency protection premium for highly rated bonds. This is supported by the empirical findings. Based on the bond offering sample, the yield spread difference of AAA bonds between SOE bonds and the matching NSOE bonds is 72 bps while the difference rises to 166 bps for the lowest rating (AA-). In the secondary market that involves more rating groups, such yield spread difference for BB bonds reaches 4,584 bps. We find that the IGG effects rose in the recent wave of corporate defaults after 2015, a clear indication of the bailout premium.

Since the implicit protection from the government to SOE bonds is not unlimited, we further present evidence that the effect of IGGs is bounded. Specifically, the effect of IGGs is stronger among firms in strategically important industry sectors, firms backed by local governments of strong fiscal conditions, and issuers with lower financial leverage. Our findings provide an additional layer of segmentation in the pricing of SOE and NSOE bonds, compared with Geng and Pan (2019), that the effect of IGGs differs across different industrial sectors and regions with heterogeneous fiscal conditions.

Our findings are relevant for investors and policymakers on the following aspects. First, the price discrimination between SOE and NSOE bonds essentially hurts SOE firms' productivity. The SOEs do not have to worry about competition and survival and are thus becoming lax about firms' performance, leading to the inefficiency of SOE firms compared to NSOE firms. This raises concerns about SOE firms' long-term competability (Song et al., 2008; Brunnermeier et al., 2017), and forces the government to raise the lower protection bound to SOEs and to reduce the bailout premium. As more corporations face greater default risk, the failure of implicit government guarantees could trigger a corporate debt crisis.

Second, such a price discrimination presents a high hurdle for NSOEs to access capital. As documented in Geng and Pan (2019), NSOEs need to compensate for their lack of outside government support by providing healthier balance sheets and better performing stocks, which is, however, unsustainable for NSOEs especially during stressful market conditions. As a result, it is more difficult for NSOE firms to raise capital from equity market investors. While the ongoing reform on issuance requirements (discussed in Section 3.1) helps ease NSOEs' access to the corporate bond market, pricing efficiency in the corporate bond market remains a critical concern for investors and policymakers.

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# Appendix A: Chinese Corporate Bond Market

**Panel A. Types of Chinese non-financial corporate bond issues**

| | Issuers | Trading venues | Outstanding Market Value (in Billion CNY) in 2018 | Starting from |
|---|---|---|---|---|
| Enterprise bonds | Non-financial institutions (mostly SOEs) | Exchange and Interbank markets | 2,560.74 | 1993 |
| Corporate bonds | Non-financial institutions (mostly listed firms) | Exchange market | 3,327.27 | 2007 |
| Medium-term notes | Non-financial institutions | Interbank market | 5,639.57 | 2008 |

**Panel B. Evolution of regulatory changes**

| Stage | Date | Requirements |
|---|---|---|
| Stage 1: Referral and Approval | 5/30/2007 | Guarantor referral and regulatory approval |
| | | Minimum requirements on past earnings and financial leverage |
| Stage 2. Approval | 1/15/2015 | Regulatory approval |
| | | Minimum requirements on net asset value, past earnings and financial leverage |
| | | No past defaults and AAA rating for issuance to public investors |
| | | No regulatory approval and minimum financial requirements for issuance to qualified investors |
| Stage 3. Registration | 3/1/2020 | Filing application and registration with regulators |
| | | No minimum requirements on net assets and financial leverage |
| | | Greater information disclosure |

# Appendix B: Proofs

**B1. Proof of $\pi_s = De^{-rT}N(-d_2) - v_0 N(-d_1) - [De^{-rT}N(-d_4) - v_0 N(-d_3)]$**

Following Eq.(8),

$$\begin{aligned}\pi_s &= e^{-rT}\int_{D-\lambda}^{D}(D-v)f(v)dv \\ &= \underbrace{e^{-rT}\int_{0}^{D}(D-v)f(v)dv}_{P_D} - \underbrace{e^{-rT}\int_{0}^{D-\lambda}(D-v)f(v)dv}_{P_{D-\lambda}}\,.\end{aligned} \tag{B1}$$

The first term of the above equation is the value of the default put and can be expressed as $De^{-rT}N(-d_2) - v_0 N(-d_1)$ under Black and Scholes (1973)'s setup, where $d_1$ is $\frac{\ln(v_0/D)+(r+\frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$ and $d_2$ is $d_1 - \sigma\sqrt{T}$.

According to Eq. (2), $v$, the asset value of the firm at $T$, follows a lognormal distribution. Namely, $\ln v$ is normally distributed with a mean of $m$ and a standard deviation of $w$, where

$$m = \ln[E_0(v)] - \frac{w^2}{2} \tag{B2}$$

and

$$w = \sigma\sqrt{T} \tag{B3}$$

Now we define a new variable

$$Y = \frac{\ln v - m}{w} \tag{B4}$$

so that $Y$ is normally distributed with a mean of zero and a standard deviation of 1. Denote the density function for $Y$ by $h(Y)$, where

$$h(Y) = \frac{1}{\sqrt{2\pi}}e^{-Y^2/2} \tag{B5}$$

Using Eq. (B4) to convert the $\int_0^{D-\lambda}(D-v)f(v)dv$ from an integral over $v$ to an integral over $Y$, we get

$$\begin{aligned}\int_0^{D-\lambda}(D-v)f(v)dv &= \int_{-\infty}^{(\ln(D-\lambda)-m)/w}(D-e^{Yw+m})h(Y)dY \\ &= D\int_{-\infty}^{(\ln(D-\lambda)-m)/w}h(Y)dY - \int_{-\infty}^{(\ln(D-\lambda)-m)/w}e^{Yw+m}h(Y)dY \\ &= D\underbrace{\int_{-\infty}^{(\ln(D-\lambda)-m)/w}h(Y)dY}_{①} - e^{m+w^2/2}\underbrace{\int_{-\infty}^{(\ln(D-\lambda)-m)/w}h(Y-w)dY}_{②}\end{aligned} \tag{B6}$$

where

$$① = N[(\ln(D-\lambda)-m)/w] = N(\frac{-\ln[E_0(v)/(D-\lambda)]+\frac{w^2}{2}}{w}) \equiv N(-d_4) \tag{B7}$$

and

$$② = N[(\ln(D-\lambda)-m)/w-w] = N(\frac{-\ln[E_0(v)/(D-\lambda)]-\frac{w^2}{2}}{w}) \equiv N(-d_3). \tag{B8}$$

Thus we can obtain

$$\int_0^{D-\lambda}(D-v)f(v)dv = DN(-d_4) - E_0(v)N(-d_3) \tag{B9}$$

and

$$e^{-rT}\int_0^{D-\lambda}(D-v)f(v)dv = De^{-rT}N(-d_4) - v_0N(-d_3). \tag{B10}$$

$\pi_s$ can be rewritten as

$$\pi_s = De^{-rT}N(-d_2) - v_0N(-d_1) - [De^{-rT}N(-d_4) - v_0N(-d_3)] \tag{B11}$$

**B2. Proof of $\frac{\partial \pi_s}{\partial v_0} < 0$ and $\frac{\partial \pi_b}{\partial v_0} \lesseqgtr 0$**

Following Eq. (B1), $\frac{\partial \pi_s}{\partial v_0} = \frac{\partial P_D}{\partial v_0} - \frac{\partial P_{D-\lambda}}{\partial v_0}$, we rewrite the first term of the above equation as

$$\begin{aligned}\frac{\partial P_D}{\partial v_0} &= -De^{-rT}\phi(d_2)\frac{\partial d_2}{\partial v_0} - 1 + N(d_1) + v_0\phi(d_1)\frac{\partial d_1}{\partial v_0} \\ &= -e^{-rT}D\frac{1}{\sqrt{2\pi}}e^{-\frac{d_1^2}{2}}e^{\frac{2d_1\sigma\sqrt{T}-\sigma^2 T}{2}}\frac{\partial d_2}{\partial v_0} - 1 + N(d_1) + v_0\phi(d_1)\frac{\partial d_1}{\partial v_0} \\ &= -D\phi(d_1)\frac{v_0}{D}\frac{\partial d_2}{\partial v_0} - 1 + N(d_1) + v_0\phi(d_1)\frac{\partial d_1}{\partial v_0} \\ &= N(d_1) - 1\end{aligned} \tag{B12}$$

We rewrite the second component of $\frac{\partial \pi_s}{\partial v_0}$ as

$$\begin{aligned}\frac{\partial P_{D-\lambda}}{\partial v_0} &= -De^{-rT}\phi(d_4)\frac{\partial d_4}{\partial v_0} - 1 + N(d_3) + v_0\phi(d_3)\frac{\partial d_3}{\partial v_0} \\ &= -e^{-rT}D\frac{1}{\sqrt{2\pi}}e^{-\frac{d_3^2}{2}}e^{\frac{2d_3\sigma\sqrt{T}-\sigma^2 T}{2}}\frac{\partial d_4}{\partial v_0} - 1 + N(d_3) + v_0\phi(d_3)\frac{\partial d_3}{\partial v_0} \\ &= -D\phi(d_3)\frac{v_0}{D}\frac{\partial d_4}{\partial v_0} - 1 + N(d_3) + v_0\phi(d_3)\frac{\partial d_3}{\partial v_0} \\ &= N(d_3) - 1\end{aligned} \tag{B13}$$

Since $d_1 < d_3$, $N(d_1) < N(d_3)$. Thus, we have $\frac{\partial \pi_s}{\partial v_0} = \frac{\partial P_D}{\partial v_0} - \frac{\partial P_{D-\lambda}}{\partial v_0} = N(d_1) - N(d_3) < 0$. $\pi_s$ decreases in $v_0$.

According to Eq. (13),

$$\pi_b = e^{-rT}[\int_K^{D-\lambda}(D-v)f(v)dv - \int_K^{D-\lambda}\delta f(v)dv]. \tag{B14}$$

The first term of the above equation can be rewritten as

$$e^{-rT}\int_K^{D-\lambda}(D-v)f(v)dv = \underbrace{e^{-rT}\int_0^{D-\lambda}(D-v)f(v)dv}_{P_{D-\lambda}} - \underbrace{e^{-rT}\int_0^{K}(D-v)f(v)dv}_{P_K} \tag{B15}$$

Consistent with the proof $\frac{\partial \pi_s}{\partial v_0} = \frac{\partial P_D}{\partial v_0} - \frac{\partial P_{D-\lambda}}{\partial v_0} < 0$, we could easily prove that $\frac{\partial P_{D-\lambda}}{\partial v_0} - \frac{\partial P_K}{\partial v_0} < 0$.

Nevertheless, assuming $\frac{\partial \delta}{\partial v} < 0$, $\frac{\partial \int_K^{D-\lambda} \delta f(v)dv}{\partial v_0}$ could be negative. Putting together, we have

$$\begin{aligned} \frac{\partial \pi_b}{\partial v_0} &= \frac{\partial P_{D-\lambda}}{\partial v_0} - \frac{\partial P_K}{\partial v_0} - \frac{\partial (e^{-rT} \int_K^{D-\lambda} \delta f(v)dv)}{\partial v_0} \\ &\lesseqgtr 0 \end{aligned} \tag{B16}$$

The relationship between $\pi_b$ and the current asset value is unclear.

## B3. Proof of $\frac{\partial \pi}{\partial K} < 0$

We first consider the case of a full bailout, i.e. $\delta = 0$. Denoting $P_K$ as the present value of the partial default put option when firm asset value falls below K, we have

$$\begin{aligned} P_K &= e^{-rT} \int_0^K (D - v) f(v) dv \\ &= De^{-rT} N(-d_6) - v_0 N(-d_5) \end{aligned} \tag{B17}$$

where $d_5$ is $\frac{\ln(v_0/K) + (r + \frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$ and $d_6$ is $d_5 - \sigma\sqrt{T}$.

$$\begin{aligned} \frac{\partial \pi}{\partial K} &= -\frac{\partial P_K}{\partial K} \\ &= -[De^{-rT}\phi(d_6)\frac{\partial(-d_6)}{\partial K} - v_0\phi(d_5)\frac{\partial(-d_5)}{\partial K}] \\ &= -\frac{1}{\sigma\sqrt{T}}\frac{1}{K}[De^{-rT}\phi(d_6) - v_0\phi(d_5)] \\ &< 0 \end{aligned} \tag{B18}$$

The value of IGG is inversely related to the lower protection bound K.

When $\delta > 0$, as long as $\delta < D - v$, i.e. $D - \delta - v > 0$, the inverse relation still holds.

## Table 1: Summary Statistics

The table reports summary statistics of issue and issuer characteristics from 2009 to September of 2019. Bond characteristics include *Yield Spread* defined as the difference between bond yield and the corresponding treasury yield at the same maturity; *Rating*, a bond's numerical credit rating based on the following conversion scheme: AAA = 7, AA+ = 6, AA = 5, AA- = 4, A = 3, BBB = 2, BB or lower = 1; *Maturity*, a bond's time to maturity in years; *Issue Size*, a bond's amount outstanding in 100 million CNY of face value; *SOE*, an indicator equal to one for a bond issued by a state-owned enterprise and zero otherwise. *Explicit Guarantee* is an indicator equal to one for a bond having a third party guarantor and zero otherwise. Issuer characteristics include *Assets* defined as a firm's total assets in 100 million CNY, *Long-term Debt/Assets*, *Operating Income/Sales*, *Return on Assets* (ROA) and *Tangibility* defined as a firm's net fixed assets scaled by its total assets. The t-statistics are reported in parentheses. All values are winsorized at the 1% and 99% level. ***, **, * denote the significance level at 1%, 5%, and 10%, respectively.

| | N | Mean | Std. | P5 | Median | P95 |
|---|---|---|---|---|---|---|
| *Bond Characteristics - Issuance Sample* | | | | | | |
| Yield Spreads (%) | 2,628 | 2.13 | 1.09 | 0.67 | 1.91 | 4.16 |
| Treasury Yield (%) | 2,628 | 3.19 | 0.45 | 2.49 | 3.18 | 3.98 |
| Coupon Rate (%) | 2,628 | 5.31 | 1.24 | 3.40 | 5.20 | 7.50 |
| Rating | 2,628 | 6.15 | 0.89 | 5.00 | 6.00 | 7.00 |
| Maturity (in years) | 2,628 | 4.44 | 1.60 | 3.00 | 5.00 | 7.00 |
| Issue Size (100 Million CNY) | 2,628 | 14.35 | 17.79 | 2.50 | 10.00 | 40.00 |
| SOE | 2,628 | 0.64 | 0.48 | 0 | 1.00 | 1.00 |
| Explicit Guarantee | 2,628 | 0.17 | 0.38 | 0 | 0 | 1.00 |
| *Bond Characteristics - Transaction Sample* | | | | | | |
| Yield Spreads (%) | 24,319 | 2.51 | 3.63 | 0.71 | 1.93 | 5.11 |
| Treasury Yield (%) | 24,319 | 3.10 | 0.55 | 2.28 | 3.08 | 4.00 |
| Rating | 24,319 | 5.92 | 0.98 | 5.00 | 6.00 | 7.00 |
| Maturity (Year) | 24,319 | 2.98 | 1.78 | 1.00 | 3.00 | 6.00 |
| *Firm Characteristics* | | | | | | |
| Assets (100 Million CNY) | 13,992 | 547.45 | 1088.22 | 33.79 | 178.85 | 2455.03 |
| Long-term Debt/Assets | 13,992 | 0.09 | 0.10 | 0.00 | 0.06 | 0.31 |
| Operating Income/Sales | 13,992 | 0.15 | 0.19 | -0.01 | 0.11 | 0.51 |
| ROA | 13,992 | 0.03 | 0.03 | 0.00 | 0.03 | 0.10 |
| Tangibility | 13,992 | 0.25 | 0.20 | 0.00 | 0.21 | 0.64 |

## Table 2: Yield Spreads of Bonds of SOEs and Firms from Strategically Important Industries

Panel A of the table reports yield spreads between state-owned enterprises (SOEs) and non state-owned enterprise (NSOEs) and between issuers of strategically important industries (SIIs) and non-strategically important industries (NSIIs). The yield spread of a corporate bond is the difference between bond yield and the corresponding treasury yield at the same maturity. Strategically important industry includes oil and gas, petrochemical, medical, power, transportation and utility sectors. Panel B of the table reports the results regressing bond yield spreads on the indicators for SOE, firms in strategically important industries, and different rating groups. All numbers of yield spreads are reported in percentage. The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

**Panel A. Comparison Analysis**

| | Issuance Sample | | | | | | | Transaction Sample | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Full | | SII | | NSII | | Difference | Full | | SII | | NSII | | Difference |
| | N | Spread | N | Spread | N | Spread | (t-stat) | N | Spread | N | Spread | N | Spread | (t-stat) |
| Full | 2,628 | 2.13 | 823 | 1.85 | 1,805 | 2.25 | -0.41***<br>(-4.05) | 23,848 | 2.52 | 7,987 | 2.28 | 15,861 | 2.65 | -0.37***<br>(-3.38) |
| SOE | 1,670 | 1.76 | 600 | 1.50 | 1,070 | 1.85 | -0.35***<br>(-3.80) | 15,078 | 1.99 | 5,806 | 1.77 | 9,272 | 2.12 | -0.35***<br>(-5.57) |
| NSOE | 958 | 2.77 | 223 | 2.62 | 735 | 2.84 | -0.22**<br>(-1.92) | 8,770 | 3.45 | 2,181 | 3.62 | 6,589 | 3.38 | 0.24*<br>(1.78) |
| Difference<br>(t-stat) | | -1.01***<br>(-15.61) | | -1.12***<br>(-11.19) | | -0.99***<br>(-10.04) | | | -1.46***<br>(-30.22) | | -1.85***<br>(-11.59) | | -1.26***<br>(-20.64) | |

**Panel B. Regressions**

| | Offering Sample | | | Transaction Sample | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| SOE | -0.61*** | | -0.62*** | -0.84*** | | -0.83*** |
| | (-15.85) | | (-4.60) | (-17.09) | | (-17.26) |
| Strategic | | -0.11* | -0.13 | | 0.10 | 0.07 |
| | | (-1.87) | (-1.60) | | (1.18) | (0.83) |
| AA+ | 0.67*** | 0.79*** | 0.68*** | 0.64*** | 0.81*** | 0.64*** |
| | (16.56) | (18.17) | (5.24) | (15.66) | (18.80) | (15.66) |
| AA | 1.17*** | 1.40*** | 1.16*** | 1.10*** | 1.44*** | 1.10*** |
| | (28.09) | (33.11) | (12.39) | (21.76) | (27.04) | (21.90) |
| AA- | 2.38*** | 2.70*** | 2.40*** | 1.98*** | 2.32*** | 1.97*** |
| | (18.02) | (19.57) | (13.37) | (8.86) | (10.46) | (8.90) |
| A | | | | 3.47*** | 3.84*** | 3.47*** |
| | | | | (4.17) | (4.58) | (4.17) |
| BBB | | | | 10.05* | 10.62** | 10.07* |
| | | | | (1.87) | (1.97) | (1.87) |
| BB and worse | | | | 40.72*** | 41.27*** | 40.74*** |
| | | | | (5.27) | (5.33) | (5.28) |
| N | 2,628 | 2,628 | 2,628 | 24,122 | 24,122 | 24,122 |
| Adj. $R^2$ | 0.528 | 0.473 | 0.530 | 0.187 | 0.178 | 0.187 |

# Table 3: Ordered Logistic Regressions of Bond Ratings

The table reports the results of ordered logistic regressions of bond ratings on firm's ownership status. The dependent variable is the numerical credit ratings from 1 (for BB and worse ratings) to 7 (for AAA rating). Bond ratings from both the issuance sample (Columns 1 and 2) and the transaction sample (Columns 3 and 4) are used. We also control firm and bond characteristics. Firm characteristics include leverage (long-term debt to assets), operating income (operating income to sales), firm size (logarithm of total assets) and tangibility (net fixed assets/total assets). Bond characteristics include bond maturity (in years), issue size (the logarithm of bond issuance amount) and explicit guarantee indicator. $Cut_1$ to $cut_6$ show the cutoff points for different credit ratings. Quarter and industry dummies are controlled but omitted from this table. The sample period is from 2009 to September of 2019. The t-statistics are reported in the parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

| | Bond Ratings from Issuance Sample | | Bond Ratings from Transaction Sample | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| SOE | 1.18*** | 1.06*** | 1.19*** | 1.13*** |
| | (11.57) | (9.78) | (37.97) | (35.45) |
| Leverage | -4.06*** | -5.74*** | -3.22*** | -3.26*** |
| | (-7.50) | (-9.55) | (-20.02) | (-20.10) |
| Operating Income | 1.43*** | 1.50*** | 0.81*** | 0.76*** |
| | (5.00) | (4.46) | (9.28) | (8.54) |
| Firm Size | 1.40*** | 1.66*** | 1.43*** | 1.26*** |
| | (22.48) | (21.77) | (83.77) | (64.49) |
| Tangibility | 0.07 | 0.47 | -0.20** | -0.35*** |
| | (0.24) | (1.43) | (-2.34) | (-3.96) |
| Issue Size | | 0.56*** | | 0.61*** |
| | | (6.56) | | (24.15) |
| Maturity (Year) | | 0.14*** | | 0.11*** |
| | | (3.40) | | (11.68) |
| Explicit Guarantee | | 2.98*** | | 0.77*** |
| | | (14.44) | | (19.89) |
| $cut_1$ | | | 25.53*** | 23.25*** |
| | | | (53.84) | (42.94) |
| $cut_2$ | | | 26.14*** | 23.86*** |
| | | | (58.23) | (45.00) |
| $cut_3$ | | | 28.37*** | 26.08*** |
| | | | (68.65) | (51.43) |
| $cut_4$ | 27.94*** | 35.85*** | 29.66*** | 27.39*** |
| | (19.72) | (21.12) | (71.72) | (56.81) |
| $cut_5$ | 32.20*** | 40.87*** | 33.51*** | 31.38*** |
| | (21.80) | (23.18) | (77.54) | (70.27) |
| $cut_6$ | 34.19*** | 43.26*** | 35.48*** | 33.45*** |
| | (22.60) | (24.06) | (80.25) | (74.90) |
| Industry FE | Yes | Yes | Yes | Yes |
| Quarter FE | Yes | Yes | Yes | Yes |
| N | 2,628 | 2,628 | 24,319 | 24,319 |
| Pseudo $R^2$ | 0.339 | 0.428 | 0.334 | 0.328 |

## Table 4: Propensity-Score Matching Analysis

Panel A reports the results of logistic regression of the propensity matching analysis for both the offering sample and the trading sample. The dependent variable is an SOE indicator. Firm characteristics include long-term debt to total assets, operating income to sales, logarithm of total asset and tangibility (net fixed assets/total assets). The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively. Panel B shows the means of selected financial characteristics for SOE firms and their matching peers. P-values for the difference in means between SOE firms and their matching peers are reported in parentheses.

Panel A. Propensity-score Matching Regression

| | Issuance Sample | Transaction Sample |
|---|---|---|
| Long-term Debt/Assets | -0.74 | -0.66** |
| | (-1.17) | (-2.41) |
| Operating Income/Sales | -0.87*** | -0.87*** |
| | (-2.62) | (-6.90) |
| Ln [Assets] | 0.44*** | 0.50*** |
| | (9.63) | (27.01) |
| Tangibility | 2.67*** | 2.32*** |
| | (7.32) | (17.50) |
| Industry FE | Yes | Yes |
| Year FE | Yes | No |
| Quarter FE | No | Yes |
| N | 2,138 | 13,972 |
| Pseudo $R^2$ | 0.184 | 0.185 |

Panel B. Firm Characteristics for SOE firms and their Matching Peers

| | Issuance Sample | | | Transaction Sample | | |
|---|---|---|---|---|---|---|
| | SOE Firms | Matching Firms | t-test (p-Value) | SOE Firms | Matching Firms | t-test (p-Value) |
| Long-term Debt/Assets | 0.10 | 0.10 | (0.75) | 0.09 | 0.10 | (0.05) |
| Operating Income/Sales | 0.16 | 0.17 | (0.45) | 0.14 | 0.17 | (0.00) |
| Ln [Assets] | 24.55 | 24.18 | (0.00) | 24.33 | 23.92 | (0.00) |
| Tangibility | 0.18 | 0.20 | (0.02) | 0.21 | 0.24 | (0.00) |

## Table 5: Yield Spread Comparison between SOEs and NSOEs: By Rating

The table reports the average yield spreads of SOE and non-SOE (NSOE) bonds and the yield spread difference between them by observed and intrinsic credit ratings. The analysis is performed for both the issuance sample and the transaction sample. Observed (Obs.) ratings are obtained from major credit rating agencies. Intrinsic (Int.) ratings of SOE bonds are estimated as the average credit ratings of the matching NSOE bonds with similar issuer and issue characteristics. The yield spread is the difference between the bond yield and the corresponding yield of the treasury bond with the same maturity. All numbers of yield spreads are reported in percentage. The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

| | SOE | | | | NSOE | | SOEs - NSOEs | |
|---|---|---|---|---|---|---|---|---|
| | Obs. Rating | | Intr. Rating | | | | Obs. Rating | Intr. Rating |
| | N | Spreads | N | Spreads | N | Spreads | Spread/(t-stat) | Spread/(t-stat) |
| *Issuance Sample* | | | | | | | | |
| AAA | 994 | 1.39 | 677 | 1.35 | 229 | 2.07 | -0.68*** | -0.72*** |
| | | | | | | | (-9.89) | (-10.37) |
| AA+ | 374 | 2.04 | 437 | 1.85 | 262 | 2.68 | -0.63*** | -0.82*** |
| | | | | | | | (-8.01) | (-10.84) |
| AA | 285 | 2.54 | 512 | 2.12 | 431 | 3.06 | -0.51*** | -0.93*** |
| | | | | | | | (-7.64) | (-15.22) |
| AA- | 17 | 3.78 | 46 | 2.74 | 36 | 4.41 | -0.63*** | -1.66*** |
| | | | | | | | (-2.74) | (-7.35) |
| *Transaction Sample* | | | | | | | | |
| AAA | 7,842 | 1.58 | 4,622 | 1.51 | 1,163 | 2.36 | -0.79*** | -0.85 *** |
| | | | | | | | (-7.89) | (-8.49) |
| AA+ | 3,902 | 2.12 | 3,434 | 1.98 | 2,254 | 3.15 | -1.02*** | -1.17*** |
| | | | | | | | (-11.34) | (-12.84) |
| AA | 3,581 | 2.58 | 6,551 | 2.22 | 4,884 | 3.37 | -0.79*** | -1.15*** |
| | | | | | | | (-11.70) | (-17.98) |
| AA- | 283 | 3.25 | 756 | 2.59 | 420 | 4.65 | -1.41*** | -2.06*** |
| | | | | | | | (-3.32) | (-6.03) |
| A | 89 | 2.50 | 303 | 2.27 | 179 | 8.08 | -5.58*** | -5.81*** |
| | | | | | | | (-4.40) | (-4.61) |
| BBB | 1 | 10.65 | 17 | 2.64 | 14 | 13.49 | -2.84 | -10.84** |
| | | | | | | | (-0.12) | (-2.28) |
| BB and worse | 2 | 9.65 | 17 | 2.70 | 16 | 48.55 | -38.90 | -45.84*** |
| | | | | | | | (-1.53) | (-5.60) |

## Table 6: Solvency Protection and Bailout Effects: Panel Regression

The table reports regression results of IGG effect on bond yield spreads controlling for bond as well as firm characteristics variables. The sample period is from 2009 to September 2019. The dependent variable is bond yield spread (stated in percentage) from the issuance sample (Column 1) and yield spread from the transaction sample (Column 2), respectively. We apply panel regressions for both offering yield spreads and trading yield spreads. SOE indicates the firm's ownership status. Bond characteristics include credit ratings, maturity, issue size (logarithm of bond issuance amount), Illiquidity (Amihud measure) and explicit guarantee indicator. For credit rating, we apply the intrinsic credit rating which is estimated as the average credit rating of the matching non-SOE (NSOE) bonds with similar issuer and issue characteristics. Firm characteristics include leverage (long-term debt to assets), operating income (operating income to sales) and firm size (logarithm of total assets). The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

| | Issuance Sample | Transaction Sample |
|---|---|---|
| | (1) | (2) |
| SOE | -0.51*** | -0.53*** |
| | (-8.22) | (-4.67) |
| AA+ | 0.65*** | 0.78*** |
| | (8.28) | (5.23) |
| AA | 0.96*** | 1.05*** |
| | (13.19) | (7.28) |
| AA- | 2.07*** | 2.25*** |
| | (11.17) | (5.85) |
| A | | 5.29*** |
| | | (3.86) |
| BBB | | 16.53* |
| | | (1.75) |
| BB and worse | | 43.98*** |
| | | (5.27) |
| SOE * AA+ | -0.34*** | -0.59*** |
| | (-3.81) | (-4.00) |
| SOE * AA | -0.44*** | -0.56*** |
| | (-5.70) | (-4.07) |
| SOE * AA- | -1.13*** | -1.58*** |
| | (-4.87) | (-4.13) |
| SOE * A | | -4.69*** |
| | | (-4.12) |
| SOE * BBB | | -15.63* |
| | | (-1.75) |
| SOE *BB and worse | | -42.15*** |
| | | (-5.26) |
| Leverage | 1.22*** | 1.25*** |
| | (7.49) | (6.26) |
| Operating Income | -0.59*** | -1.50*** |
| | (-6.38) | (-11.84) |
| Firm Size | -0.07*** | -0.15*** |
| | (-3.57) | (-5.28) |
| Illiquidity | | 31.60*** |
| | | (5.13) |
| Issue Size | -0.14*** | 0.06 |
| | (-5.83) | (1.53) |
| Maturity (year) | -0.05*** | -0.08*** |
| | (-5.22) | (-8.24) |
| Explicit Guarantee | 0.26*** | 0.11* |
| | (5.41) | (1.84) |
| Industry FE | Yes | Yes |
| Quarter FE | Yes | Yes |
| N | 2,630 | 22,806 |
| Adj. $R^2$ | 0.524 | 0.210 |

## Table 7: Solvency Protection and Bailout Effects around 2015

The table reports the average yield spreads of SOE and non-SOE (NSOE) bonds and the yield spread difference between them by intrinsic credit ratings of the transaction sample around 2015. Intrinsic ratings of SOE bonds are estimated as the average credit ratings of the matching NSOE bonds with similar issuer and issue characteristics. The yield spread is the difference between the bond yield and the corresponding yield of the treasury bond with the same maturity. All numbers of yield spreads are reported in percentage. The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

| | 2010-2014 | | | | | 2015-2019 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SOE | | NSOE | | Difference | SOE | | NSOE | | Difference |
| | N | Spreads | N | Spreads | (t-stat) | N | Spreads | N | Spreads | (t-stat) |
| AAA | 1,480 | 1.52 | 118 | 2.37 | -0.85***<br>(-5.75) | 2,955 | 1.53 | 970 | 2.4 | -0.87***<br>(-7.30) |
| AA+ | 1,061 | 2.02 | 482 | 2.45 | -0.42***<br>(-9.42) | 2,254 | 1.98 | 1,732 | 3.33 | -1.35***<br>(-11.38) |
| AA | 2,026 | 2.35 | 1,567 | 3.06 | -0.71***<br>(-21.36) | 4,378 | 2.17 | 3,259 | 3.52 | -1.34***<br>(-14.27) |
| AA- | 269 | 2.57 | 178 | 3.9 | -1.33***<br>(-14.03) | 479 | 2.62 | 240 | 5.22 | -2.59***<br>(-4.43) |
| A | 3 | 1.48 | 2 | 3.09 | -1.61***<br>(-4.85) | 291 | 2.31 | 175 | 8.15 | -5.85***<br>(-4.54) |
| BBB | | | | | | 17 | 2.64 | 14 | 13.49 | -10.84**<br>(-2.28) |
| BB and worse | | | | | | 17 | 2.7 | 16 | 48.55 | -45.85***<br>(-5.60) |

## Table 8: Industry Effect on Implicit Government Guarantees

The table reports regression results of industry analysis on IGGs. The dependent variable is IGG, which is defined as the difference between the yield spread of a NSOE bond and an SOE bond with matching characteristics. The results of the issuance sample (in Columns 1 to 4) and the transaction sample (in Columns 5 to 8) are reported respectively. Strategic industries include oil and gas, petrochemical, medical, power, transportation and utility sectors. Overcapacity includes mining, steel, real estate and construction sectors. Commercial service includes retail, wholesale, hotel, restaurant, and commercial service sectors. We also control intrinsic credit rating which is estimated as the average credit rating of the matching NSOE bond with similar issuer and issue characteristics. Firm characteristics include operating income (operating income to sales) and firm size (logarithm of total assets). Bond characteristics include illiquidity (Amihud measure) and explicit guarantee indicator. The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

| | Issuance Sample | | | | Transaction Sample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Strategic | 0.33*** | | | | 0.22** | | | |
| | (3.25) | | | | (2.32) | | | |
| Overcapacity | | -0.04 | | | | -0.03 | | |
| | | (-0.40) | | | | (-0.25) | | |
| Commercial | | | -0.13 | | | | -0.15 | |
| | | | (-0.85) | | | | (-0.75) | |
| Others | | | | -0.17 | | | | -0.11 |
| | | | | (-1.47) | | | | (-1.00) |
| AA+ | 0.78*** | 0.76*** | 0.77*** | 0.76*** | 1.34*** | 1.33*** | 1.34*** | 1.33*** |
| | (5.48) | (5.35) | (5.38) | (5.31) | (9.61) | (9.49) | (9.50) | (9.52) |
| AA | 1.46*** | 1.43*** | 1.44*** | 1.42*** | 2.00*** | 1.99*** | 1.99*** | 1.98*** |
| | (10.14) | (9.99) | (10.00) | (9.92) | (12.11) | (12.00) | (11.95) | (11.98) |
| AA- | 2.86*** | 2.89*** | 2.88*** | 2.87*** | 2.16*** | 2.17*** | 2.17*** | 2.16*** |
| | (10.23) | (10.10) | (10.09) | (10.19) | (12.08) | (12.05) | (12.06) | (12.01) |
| A | | | | | 1.95** | 1.94** | 1.94** | 1.93** |
| | | | | | (2.44) | (2.42) | (2.43) | (2.41) |
| BBB | | | | | 19.69*** | 19.70*** | 19.74*** | 19.68*** |
| | | | | | (2.91) | (2.91) | (2.91) | (2.90) |
| BB and worse | | | | | 35.88*** | 35.89*** | 35.87*** | 35.85*** |
| | | | | | (4.98) | (4.98) | (4.98) | (4.97) |
| Operating Income | 1.05*** | 1.16*** | 1.13*** | 1.09*** | 0.77*** | 0.89*** | 0.87*** | 0.83*** |
| | (4.48) | (4.98) | (4.91) | (4.66) | (4.01) | (4.61) | (4.46) | (4.35) |
| Firm Size | 0.32*** | 0.31*** | 0.30*** | 0.29*** | 0.07* | 0.06 | 0.06 | 0.05 |
| | (7.64) | (7.26) | (7.26) | (6.96) | (1.81) | (1.51) | (1.42) | (1.29) |
| Illiquidity | | | | | 3.39 | 3.35 | 3.34 | 3.49 |
| | | | | | (0.31) | (0.31) | (0.30) | (0.32) |
| Explicit Guarantee | 0.19 | 0.17 | 0.16 | 0.14 | 0.10 | 0.10 | 0.09 | 0.09 |
| | (1.45) | (1.33) | (1.23) | (1.05) | (0.89) | (0.83) | (0.74) | (0.80) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 758 | 758 | 758 | 758 | 7,764 | 7,764 | 7,764 | 7,764 |
| Adj. $R^2$ | 0.274 | 0.265 | 0.266 | 0.268 | 0.184 | 0.184 | 0.184 | 0.184 |

## Table 9: Implicit Government Guarantees and Government Fiscal Condition

The table reports regression results of the effects of government fiscal conditions on IGGs from 2009 to September of 2019. The dependent variable is IGG, which is defined as the difference between the yield spread of a non-SOE (NSOE) bond and an SOE bond with matching characteristics. The results of the issuance sample (in Columns 1 to 3) and the transaction sample (in Columns 4 to 6) are reported respectively. SOE, CSOE (central SOE), and LSOE (local SOE) indicate the firm ownership status. Revenue/expense is the ratio of province government revenue to expense. GDP portion is the ratio of province GDP to the total country GDP. Rating is the intrinsic credit rating which is estimated as the average credit rating of the matching NSOE bonds with similar issuer and issue characteristics. We also control firm characteristics including operating income (operating income to sales) and firm size (logarithm of total assets). Issue characteristics include illiquidity (Amihud measure) and explicit guarantee indicator. The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

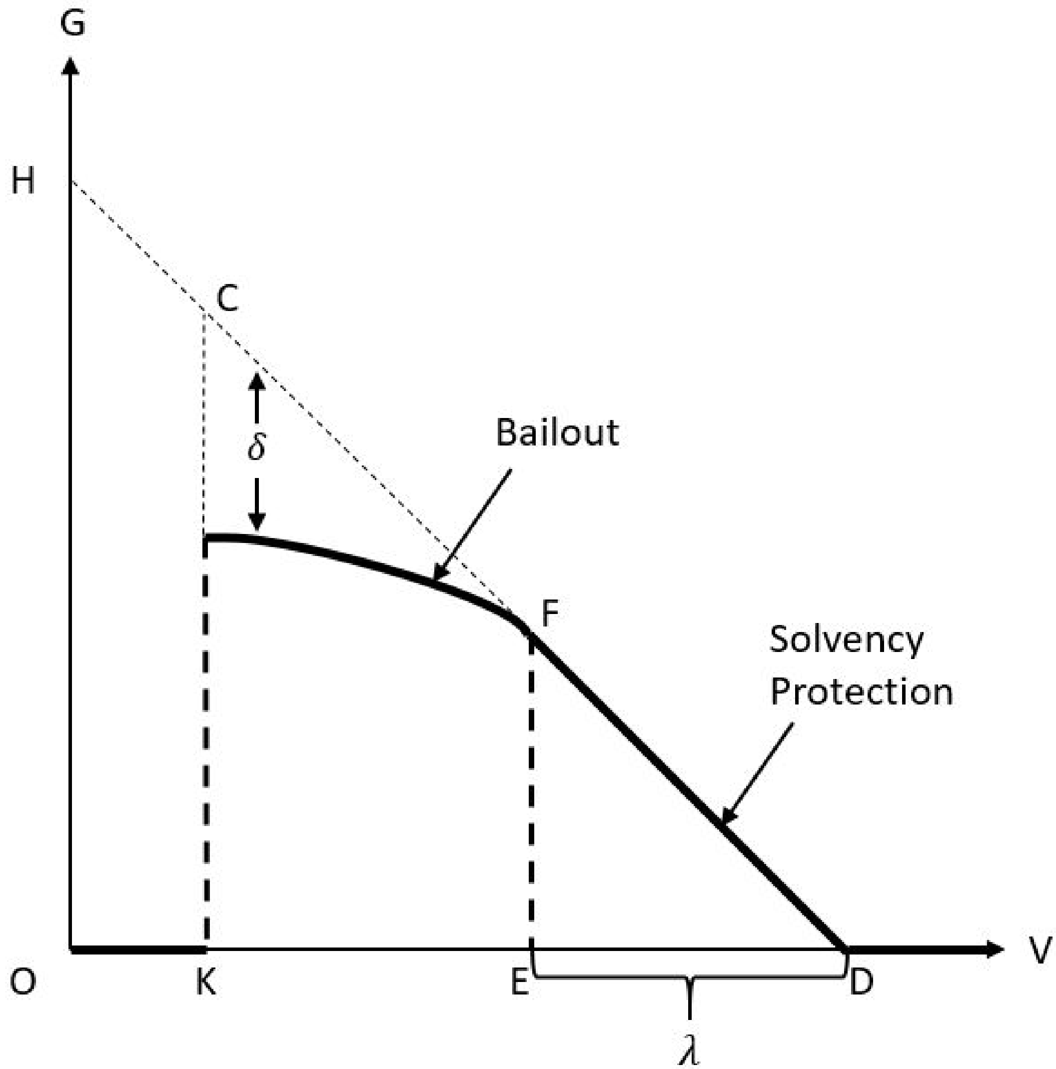
| | Issuance Sample | | | Transaction Sample | | |
|---|---|---|---|---|---|---|
| | SOE | LSOE | LSOE | SOE | LSOE | LSOE |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| CSOE | 0.28*** | | | 0.27*** | | |
| | (2.72) | | | (5.18) | | |
| Revenue/Expense | | 1.62*** | | | 1.29*** | |
| | | (5.35) | | | (6.61) | |
| GDP % | | | 2.14 | | | 3.73*** |
| | | | (1.26) | | | (3.22) |
| Rating | -0.72*** | -0.79*** | -0.77*** | | -0.47*** | -0.45*** |
| | (-9.88) | (-8.73) | (-8.49) | | (-8.55) | (-8.22) |
| Operating Income | 0.85*** | 1.41*** | 1.60*** | 1.30*** | 1.11*** | 1.16*** |
| | (3.00) | (4.38) | (4.97) | (7.87) | (5.80) | (6.12) |
| Firm Size | 0.22*** | 0.20*** | 0.26*** | 0.05* | 0.02 | 0.07* |
| | (4.87) | (3.27) | (4.16) | (1.88) | (0.54) | (1.71) |
| Illiquidity | | | | 0.86 | -5.29 | -4.67 |
| | | | | (0.26) | (-1.06) | (-0.97) |
| Explicit Guarantee | 0.16 | 0.10 | 0.12 | 0.09 | 0.17 | 0.16 |
| | (1.26) | (0.72) | (0.82) | (1.24) | (1.53) | (1.55) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 652 | 441 | 443 | 6,795 | 4,720 | 4,756 |
| Adj. $R^2$ | 0.229 | 0.343 | 0.299 | 0.089 | 0.091 | 0.083 |

## Table 10: Leverage Effect on Implicit Government Guarantees

The table reports the regression results of leverage effects on IGGs from 2009 to September 2019. The dependent variable is IGG, which is defined as the difference between the yield spread of a NSOE bond and an SOE bond with matching characteristics. The results of the issuance sample (in Columns 1 to 3) and the transaction sample (in Columns 4 to 6) are reported respectively. The main independent variable is the book leverage, which is defined as the total debts to total debts and book value of equity. We also include the high leverage indicator, which is equal to 1 if firms have a leverage ratio greater than 0.5. Rating is the intrinsic credit rating which is estimated as the average credit rating of the matching NSOE bonds with similar issuer and issue characteristics. We control firm characteristics including operating income (operating income to sales) and firm size (logarithm of total assets). Bond characteristics include illiquidity (Amihud measure) and explicit guarantee indicator. The t-statistics are reported in parentheses. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively.

| | Issuance Sample | | | Transaction Sample | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Leverage | -1.11*** | -1.43*** | | -1.65*** | -1.36*** | |
| | (-3.90) | (-5.12) | | (-6.54) | (-5.14) | |
| High Leverage | | | -0.85*** | | | -0.68*** |
| | | | (-3.98) | | | (-4.34) |
| AA+ | | 0.83*** | 0.84*** | | 1.34*** | 1.35*** |
| | | (5.94) | (5.97) | | (9.51) | (9.64) |
| AA | | 1.54*** | 1.56*** | | 1.97*** | 1.98*** |
| | | (10.74) | (10.78) | | (11.53) | (11.64) |
| AA- | | 3.00*** | 3.00*** | | 2.13*** | 2.15*** |
| | | (11.03) | (10.78) | | (12.60) | (12.65) |
| A | | | | | 1.81** | 1.83** |
| | | | | | (2.29) | (2.31) |
| BBB | | | | | 19.62*** | 19.62*** |
| | | | | | (2.90) | (2.90) |
| BB and worse | | | | | 35.29*** | 35.37*** |
| | | | | | (4.86) | (4.88) |
| Operating Income | | 0.64** | 0.74*** | | 0.28 | 0.36 |
| | | (2.47) | (2.87) | | (1.11) | (1.39) |
| Firm Size | | 0.32*** | 0.29*** | | 0.08* | 0.06 |
| | | (7.38) | (6.78) | | (1.74) | (1.47) |
| Illiquidity | | | | | 1.69 | 1.70 |
| | | | | | (0.15) | (0.15) |
| Explicit Guarantee | | 0.16 | 0.16 | | 0.05 | 0.05 |
| | | (1.28) | (1.26) | | (0.44) | (0.44) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 758 | 758 | 758 | 8,300 | 7,805 | 7,805 |
| Adj. $R^2$ | 0.152 | 0.325 | 0.314 | 0.098 | 0.190 | 0.189 |

**Figure 1: The Implicit Government Guarantees Payoff to Bondholders**




The figure shows the payoff from the implicit government guarantees (IGGs), denoted as $G$. $D$ is the face value of firm's outstanding debt. $K$ denotes the lower bound of the government protection. The solid line represents the payoff from the IGGs, consisting of solvency protection and bailout. $\lambda$ denotes the threshold value from the enhancement of firm value to keep firm away from insolvency, i.e. the solvency protection. When the firm value is below $D-\lambda$ and above $K$, the firm is in default and bond investors receive bailout payments $D - \delta$. When the firm value is below $K$, i.e., the firm is in a deep distress state, the government may walk away and let it default. When the firm value exceeds $D$, as an out-of-money put option, $G$ equals to zero.

**Figure 2: Annual Issuance Amount and Number of Bonds issued by Chinese Enterprises**

Figure 2.1 Number of Bond Issues

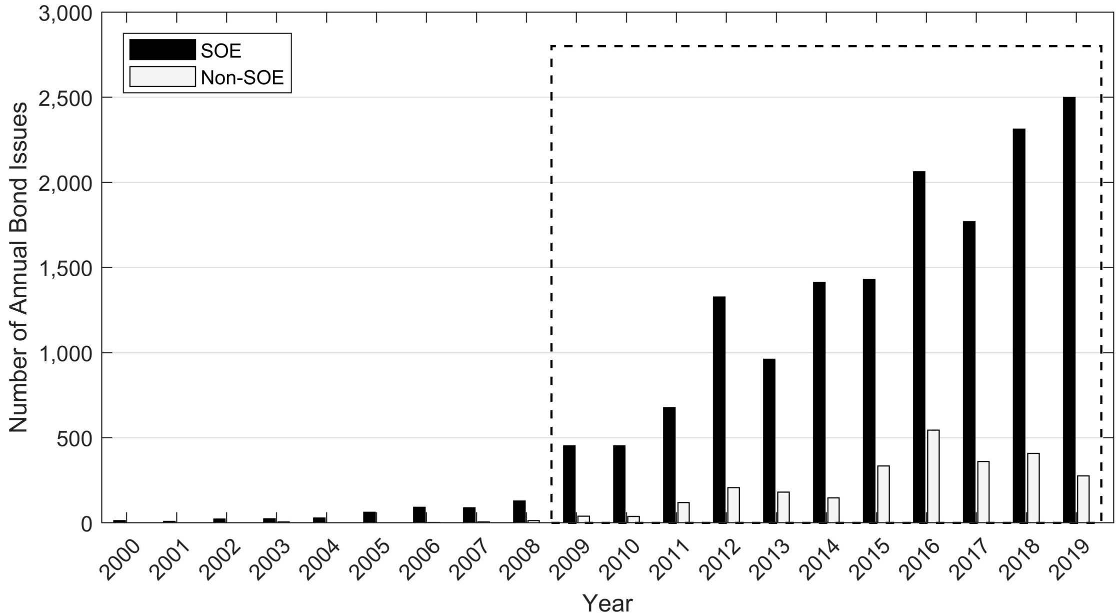
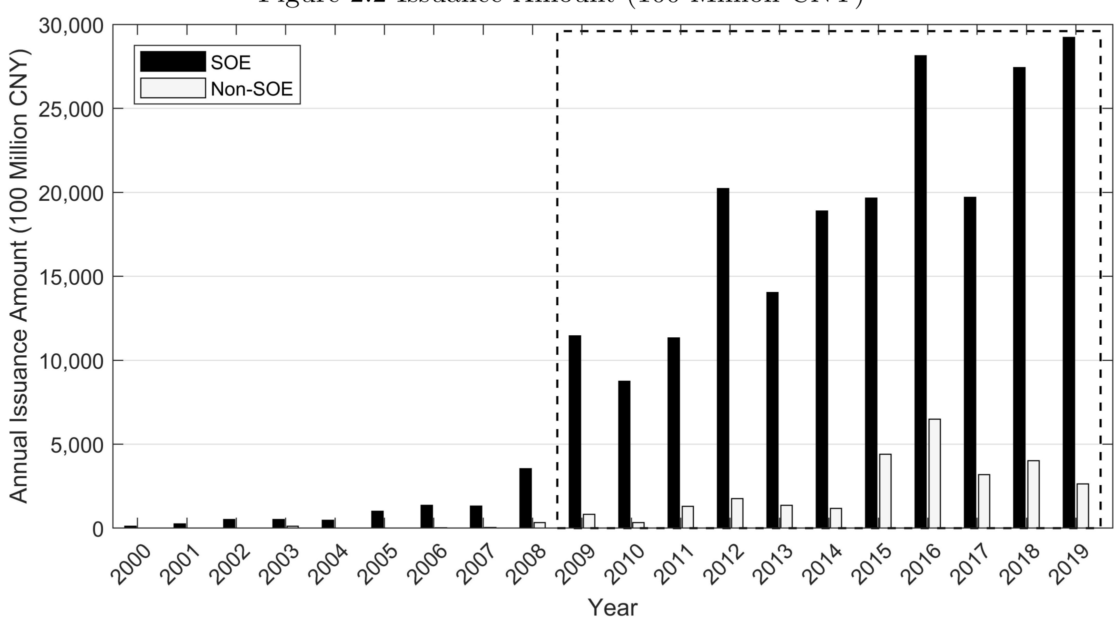
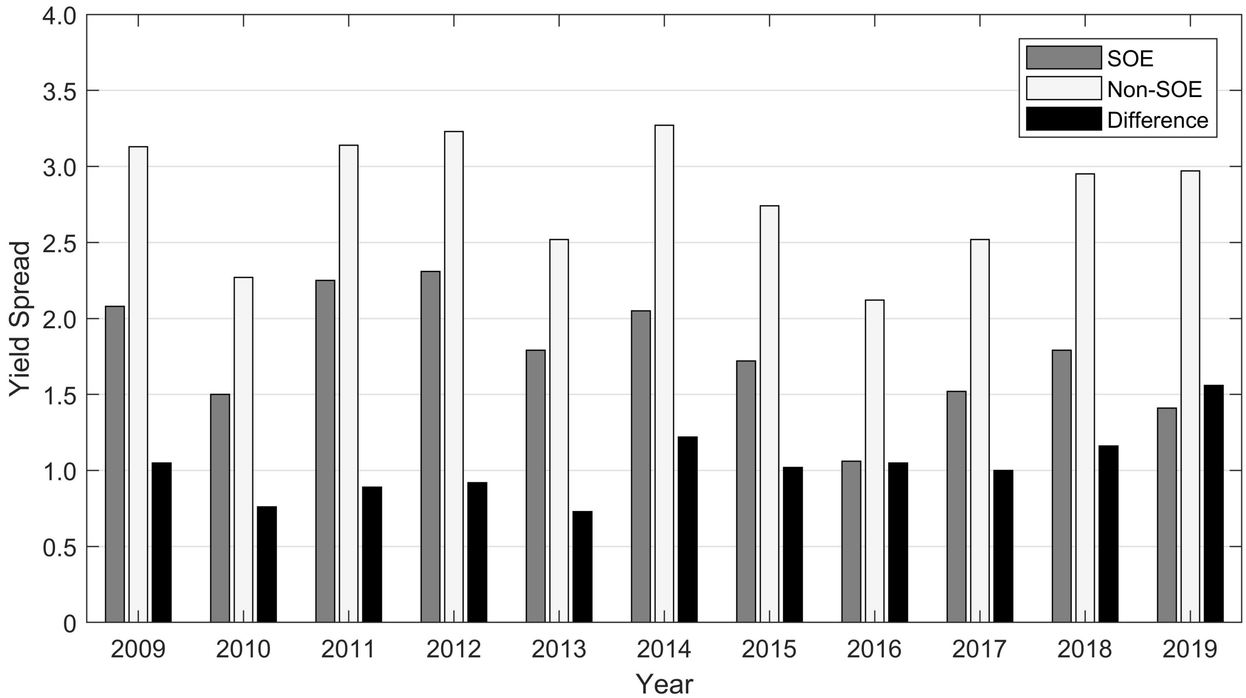



Figure 2.2 Issuance Amount (100 Million CNY)




These figures present the annual issuance amount and the number of SOE and non-SOE bonds issued by Chinese enterprises from 2000 to 2019.

**Figure 3: Yield Spreads of SOE and non-SOE Bonds**




The figure shows the average yield spreads and yield spread difference between SOE and non-SOE bonds in the sample from 2009 to 2019.

**Figure 4: Number and Value of Bond Defaults**

Figure 4.1 Number of Defaults

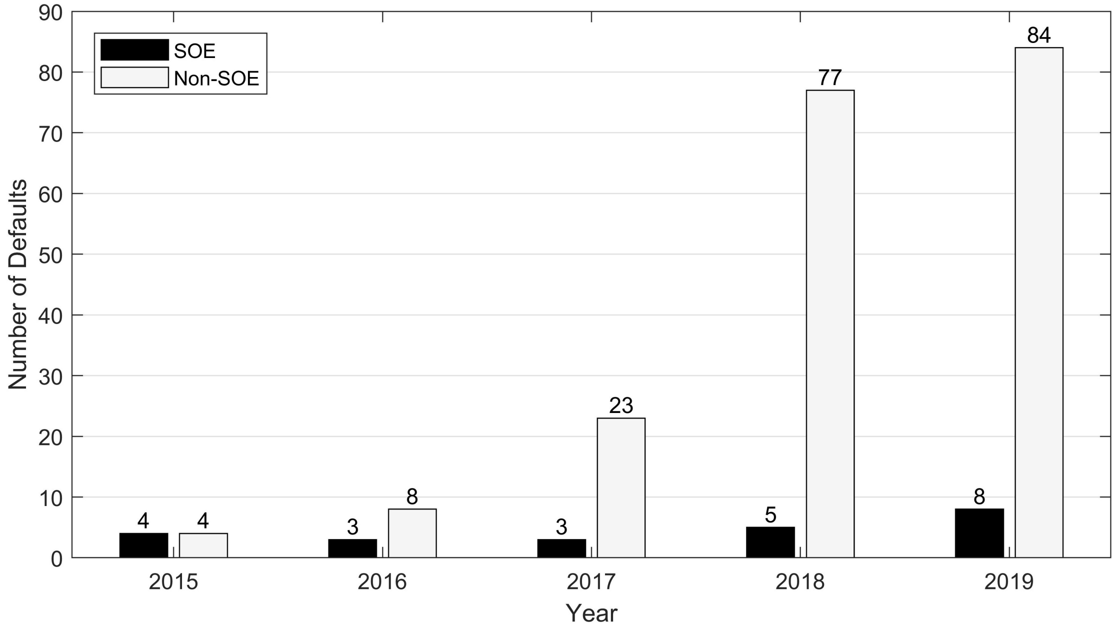
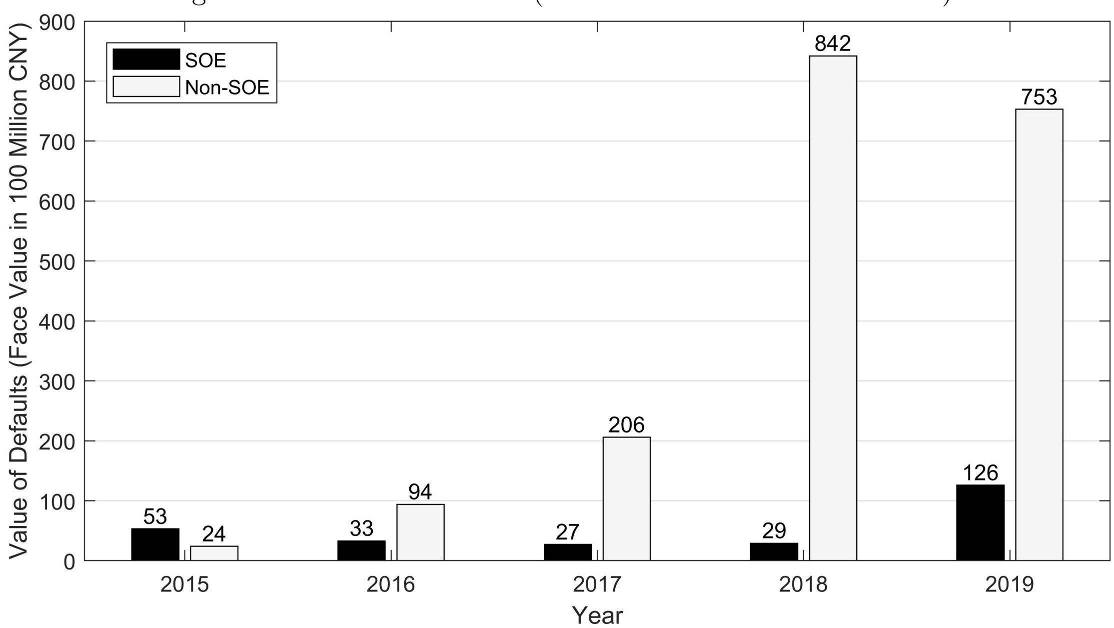



Figure 4.2 Value of Defaults (Face Value in 100 Million CNY)




These figures show the number and value of defaults of SOE and non-SOE bonds from 2015 to 2019Q3.

## Figure 5: Predictions for Probability of Receiving Bond Ratings

Figure 5.1 Rating Distribution at Bond Issuances

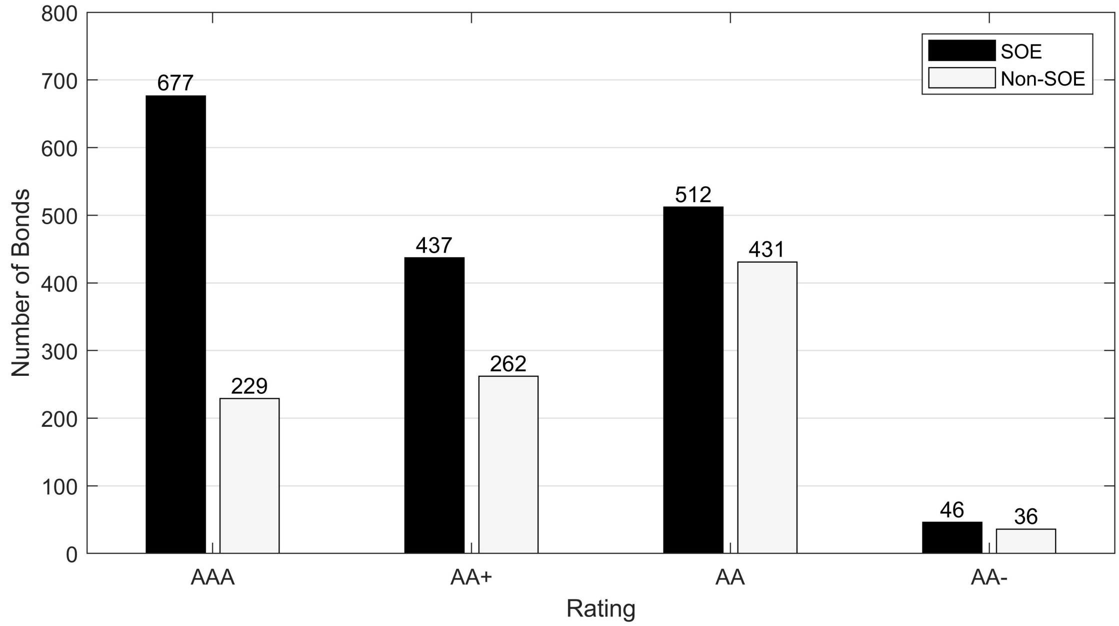
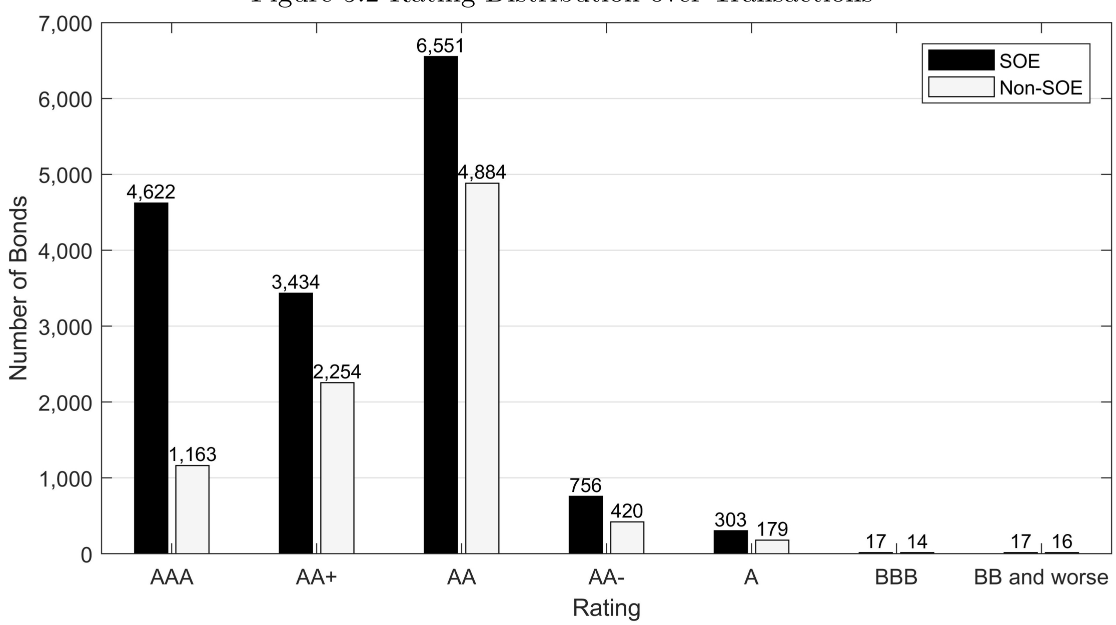



Figure 5.2 Rating Distribution over Transactions




These figures show the distribution of bond ratings for SOEs and non-SOEs. Figure 5.1 shows the distribution of bond ratings at offerings and Figure 5.2 shows the distribution of bond ratings over transactions.

## Appendix Table 1: Migration Matrix from Intrinsic to Observed Ratings

The table reports transitions from observed ratings to intrinsic ratings and the yield spread difference between SOEs and the matching non-SOEs (NSOEs). Panel A and B show the transitions from intrinsic ratings to observed ratings at issuance and over transactions, respectively. Observed ratings are obtained from major rating agencies. Intrinsic rating is estimated as the average credit rating of the matching NSOE bonds with similar issuer and issue characteristics. The numbers in boldface report the number of inflated SOE bonds, i.e., bonds with observed ratings higher than intrinsic ratings.

**Panel A. Migration from Intrinsic to Observed Ratings at Issuance**

| | Intrinsic Rating | | | |
|---|---|---|---|---|
| Observed Rating | AAA | AA+ | AA | AA- |
| AAA | 191 | **173** | **134** | **10** |
| AA+ | 4 | 197 | **108** | **3** |
| AA | 0 | 2 | 153 | **16** |
| AA- | 0 | 1 | 0 | 2 |
| Total | 195 | 373 | 395 | 31 |

**Panel B. Migration from Intrinsic to Observed Ratings at Transactions**

| | Intrinsic Rating | | | | | | |
|---|---|---|---|---|---|---|---|
| Observed Rating | AAA | AA+ | AA | AA- | A | BBB to B | CCC or worse |
| AAA | 742 | **1,404** | **1,544** | **169** | **93** | **8** | **2** |
| AA+ | 13 | 920 | **1,660** | **141** | **59** | **9** | **3** |
| AA | 0 | 7 | **2,226** | **181** | **49** | **1** | **3** |
| AA- | 0 | 0 | 1 | **28** | **15** | **1** | **2** |
| A | 0 | 0 | 0 | 0 | 8 | **0** | **2** |
| Total | 755 | 2,331 | 5,431 | 519 | 224 | 19 | 12 |