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Assessing the Value of Implicit Government Guarantees in State-Owned Enterprise Bonds: Insights from Credit Default Swaps

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Abstract

Accurately pricing the impact of implicit government guarantees on SOE bonds is crucial for ensuring their reasonable valuation. In this paper, we conceptualize the implicit government guarantee effect as a credit default swap (CDS) implicitly sold by the government and develop a pricing framework based on the transaction mechanism of CDS. Specifically, we construct a structural pricing model that incorporates the probability of government intervention conditional on default. Using numerical simulation under different default intensities and government intervention probabilities, we quantify the value of the implicit government guarantee effect. The simulation results show that, as the credit risk of SOE bonds increases, the value of the implicit government guarantee effect rises correspondingly. Moreover, the price of government intervention exhibits a complex nonlinear relationship with both default intensity and the government's willingness to provide implicit guarantees. Overall, this study establishes an internal pricing mechanism through numerical simulations to explain how implicit government guarantees affect the credit risk of SOE bonds.

Keywords

Implicit Government Guarantees, Price of Implicit Government Guarantees, Credit Default Swap

1. Introduction

The phenomenon of governments bailing out large financial institutions during financial crises to mitigate systemic risks is well-documented, reflecting the existence of an implicit government guarantee (Cutura, 2021; Schich & Lindh, 2012;

Zhao, 2018; Akram & Casper, 2017; Irwin & Vines, 2003; Hahn, Momtaz, & Wieandt, 2023; Feng, Liu, & Fang, 2023). Schich and Lindh (2012) examine the prevalence of implicit government guarantees for bank debt, analyzing their determinants and estimating their value, with a particular focus on the impact of government bailouts of U.S. financial institutions during the 2008-2009 financial crisis. Overall, implicit government guarantees have a significant effect on credit spreads and the contagion of financial risk among financial institutions (Zhang, 2023; Zhang, Li, & Tian, 2022; Dong, Dong, & Xuan, 2023; Dong, Hou, & Ni, 2021).

In the Chinese financial market, government credit plays a critical and distinctive role in the bond market. Depending on whether a clear legal and institutional basis exists, government credit support can generally be classified into explicit and implicit guarantees. Explicit guarantees refer to legally binding commitments made by the government or its authorized entities through laws, contracts, or formal policy documents to ensure the repayment of specific liabilities, such as sovereign bonds, local government bonds, and approved policy-based guarantee arrangements. These guarantees feature clearly defined responsibility boundaries and legal enforceability, and their scale and scope are strictly regulated under institutional frameworks such as the Budget Law.

By contrast, implicit guarantees are not supported by formal legal commitments but arise from market expectations that the government may intervene or provide financial support in the event of distress. Such expectations are primarily shaped by the ownership structure of state-owned enterprises (SOEs) and local government financing platforms (LGFPs), their economic importance at the local or national level, and the government's historical record of intervention and bailout actions. Implicit guarantees have long been regarded as a key institutional feature of China's credit market and are widely believed to have weakened market-based risk pricing mechanisms. In recent years, as policymakers have advanced reforms aimed at "breaking rigid repayment guarantees" and containing systemic financial risks, regulators have explicitly emphasized the gradual reduction of implicit guarantees. Nevertheless, their influence has not been fully eliminated and continues to exhibit substantial heterogeneity across entities, regions, and time periods.

The existing literature generally finds that implicit guarantees exert a significant impact on credit spreads and default risk pricing in the Chinese bond market. A large body of empirical evidence shows that, after controlling for firm-level financial characteristics and macroeconomic conditions, bonds issued by SOEs and LGFPs exhibit systematically lower financing costs than those issued by otherwise comparable private firms (Hu & Wang, 2022; Zhang & Wang, 2023; Jin, Wang, & Zhang, 2023; Zhang & Wang, 2020). This so-called ownership premium is commonly interpreted as evidence of implicit government support. Further studies suggest that implicit guarantees are inherently heterogeneous and exhibit a hierarchical structure: central SOEs and core LGFPs tend to benefit from stronger implicit support, while local SOEs located in regions with greater fiscal capacity enjoy more pronounced financing advantages.

This paper differs from existing studies on implicit government guarantees, which primarily examine their effects on financial institutions. Additionally, our research diverges from studies that focus on identifying proxy variables for implicit government guarantees and subsequently analyzing their relationship with bond credit spreads. Furthermore, our approach is distinct from methodologies that price implicit government guarantees using structural credit models, such as contingent claim analysis (Zhang, Li, & Tian, 2022). This study makes two key contributions to the literature. First, it introduces a novel perspective based on the risk transfer mechanism of CDS to explain the existence of implicit government guarantees. Second, it quantifies the value of implicit government guarantees by examining counterparty default risk in the CDS market.

The remainder of the paper is organized as follows. Section 2 presents the theoretical model for pricing implicit government guarantees based on the mechanism of CDS. Section 3 discusses numerical simulation calculations and examines the impact of relevant variables on the pricing of implicit government guarantees. Section 4 summarizes the conclusions.

2. Value of Implicit Government Guarantees

When investors hold bonds issued by SOE, the implicit government guarantee functions similarly to bondholders purchasing credit default protection from the government, with the government effectively acting as the seller of default risk swaps. In the event of an SOE default, the government is expected to intervene and cover the debt obligations. However, this implicit guarantee is not equivalent to a formal CDS contract, as there remains uncertainty regarding the government's willingness to fulfill these obligations. If the government chooses not to repay the SOE's debt, the implicit guarantee fails to be enforced, resembling counterparty default in a CDS transaction. Therefore, this study proposes measuring the value of implicit government guarantees through the lens of counterparty default risk in CDS contracts. However, in practice, bondholders do not pay explicit premiums for this guarantee. As a result, the value of implicit government guarantees can be approximated by the credit spread obtained when premium payments approach zero.

Empirical research indicates that the yields on state-owned enterprise (SOE) bonds are significantly lower than those on non-state-owned enterprise bonds. This yield difference can be interpreted as bondholders effectively allocating a portion of the coupon payments toward the cost of CDS protection. Consequently, the value of implicit government guarantees can be approximated by the implied cost of a CDS contract.

Assuming a bond with a face value of $100 and a time to maturity of T, the fee for the CDS is denoted as s. The annual payment rate for the CDS fee is given by 100 s, representing the cost of credit protection as a percentage of the bond's face value per year.

If there is no default, the total present value of the swap premium paid by the CDS buyer over the life of the contract is denoted as P_T. This value represents the discounted sum of periodic CDS premium payments made until maturity P_T. It can be expressed as:

$$P_T = 100s\sum_{k=1}^{T}\frac{1}{(1+y)^k} \tag{1}$$

y is referred to as the discount rate. Let $u(T)=\sum_{k=1}^{T}\frac{1}{(1+y)^k}$, then there is:

$$P_T = 100s \times u(T) \tag{2}$$

Assuming the bond defaults at time t, $0 < t \le T$, t^* is the payment date immediately preceding time t, so $0 < t^* < t \le T$, $0 < t - t^* < 1$.

At this time, the present value of the total fee of credit default swap is P_t:

$$P_t = 100s\sum_{k=1}^{t^*}\frac{1}{(1+y)^k} + \frac{100s(t-t^*)}{(1+y)^t} \tag{3}$$

Let

$$e(t) = \frac{t-t^*}{(1+y)^t}$$

$$u(t^*) = \sum_{k=1}^{t^*}\frac{1}{(1+y)^k} = \frac{(1+y)^{t^*}-1}{y(1+y)^{t^*}}$$

Then $e(t)$ is the present value of an accrual payment at time t equal to $t-t^*$. the present value of the total fee of credit default swap is P_t

$$P_t = 100s \times \left(u(t^*) + e(t)\right) \tag{4}$$

Other asumption as follows:

1) $q(t)$ is Risk-neutral default probability density at time t.

2) π is the risk-neutral probability of no default event during the life of the swap:

$$\pi = 1 - \int_0^T q(t)\,\mathrm{d}t \tag{5}$$

If there is no default prior to time T, the present value of the payments is $100su(T)$.

The expected present value of the payments P_t is:

$$E(P_t) = \pi 100su(t) + 100s\int_0^t q(t)\left[u(t)+e(t)\right]\mathrm{d}t \tag{6}$$

Further, Assuming $\hat{R}$ is expected recovery rate on the reference obligation in a risk-neutral world. This is assumed to be independent of the time of the default and the same as the recovery rate on the bonds used to calculate $q(t)$.

$A(t)$ is accrued interest on the reference obligation at time t as a percent of face value. If default at time t, $A(t)$ is as follow.

$$A(t)=\frac{100c\left(t-t^{*}\right)}{100}=c\left(t-t^{*}\right) \tag{7}$$

c is the coupon of bond.

If there is a default, the seller of the credit default swap will pay compensation as follow:

$$100-100\left(1+A(t)\right)\hat{R}=100\left(1-\hat{R}-A(t)\hat{R}\right) \tag{8}$$

Since the implicit government guarantee is not a legally binding obligation, the government may choose whether to provide financial support in the event of a default by a state-owned enterprise (SOE). Let ρ represent the probability that the government is willing to extend financial assistance. Under this assumption, the present value of the expected cash flow for SOE bonds in default can be expressed as:

$$\int_0^t q(t)\left[\rho\left[100-100\left(1+A(t)\right)\hat{R}\right]+(1-\rho)\left[100\left(1+A(t)\right)\hat{R}\right]\right]v(t)\,\mathrm{d}t$$

$$100\int_0^t q(t)\left[\rho+(1-2\rho)\left(1+A(t)\right)\hat{R}\right]v(t)\,\mathrm{d}t \tag{9}$$

Let $v(t)=\mathrm{e}^{-yt}$ denotes discount factor.

If $\rho=1$, the government is always willing to provide a guarantee, meaning the cash flow is equivalent to the cash flow of a CDS. In this case, the bondholder would receive the full-face value of the bond, as the government guarantees repayment in the event of default. This result is consistent with the findings of Hull and White (2000), where the value of an implicit government guarantee in such a scenario is completely equivalent to the value of a credit default swap.

If $\rho=0$, the government is unwilling to provide any guarantees, and the cash flow for the bondholders in the event of a default is equivalent to the cash flow of a credit default swap (CDS) under counterparty default. In this case, since the government does not intervene, the bondholders would only receive recovery amounts based on the terms of the bond, which could be zero or a fraction of the face value, similar to the scenario in a CDS where the counterparty defaults.

Based on the theory of no arbitrage, the present value of the credit default swap premiums paid for holding SOE bonds should be equal to the present value of the payments obtained in the event of default. This ensures that there is no arbitrage opportunity, as the cost of protection must align with the expected payoff from the protection (the government's guarantee in case of default).

$$\pi 100 s u(t)+100 s\int_0^t q(t)\left[u(t)+e(t)\right]\mathrm{d}t$$

$$=\int_0^t q(t)\left[100\left(\rho+(1-2\rho)\left(1+A(t)\right)\hat{R}\right)\right]\mathrm{d}t$$

$$s=\frac{\int_0^t q(t)\left[\rho+(1-2\rho)\left(1+A(t)\right)\hat{R}\right]v(t)\,\mathrm{d}t}{\pi u(t)+\int_0^t q(t)\left[u(t)+e(t)\right]\mathrm{d}t}$$

$$s=\frac{\int_0^t q(t)\left[\rho+(1-2\rho)\left(1+A(t)\right)\hat{R}\right]v(t)\,\mathrm{d}t}{u(t)\left(1-\int_0^t q(t)\,\mathrm{d}t\right)+\int_0^t q(t)\left[u(t)+e(t)\right]\mathrm{d}t}$$

According to reduced form models, let $q(t) = \lambda e^{-\lambda t}$, where λ is constant default strength parameter, then there is

$$s = \frac{\int_0^t q(t)\left[\rho + (1-2\rho)(1+A(t))\hat{R}\right]v(t)\,dt}{u(t)\left(1-\int_0^t q(t)\,dt\right) + \int_0^t q(t)\left[u(t)+e(t)\right]dt} \tag{10}$$

The above formula provides the pricing of implicit government guarantees.

3. Numerical Example

Since there is no explicit solution for Equation (10), we now present a numerical example to illustrate the relationship between the value of implicit government guarantees and the independent variables. This example will help visualize how different factors, such as the probability of government intervention influence the price of the implicit government guarantee.

Firstly, we analyzed the relationship between the probability of government intervention to enforce guarantees and the pricing of implicit government guarantees. In our base case: 1) The default intensity is $\lambda = 0.03$, 2) The discount rate is $y = 0.05$, 3) The recovery rate is $\hat{R} = 0.2$ or $\hat{R} = 0.9$, 4) The time is $t = 1$. When the probability of governments being willing to provide guarantees changes from 0 to 1, the price of implicit government guarantees for state-owned enterprise bonds is shown in **Figure 1**.

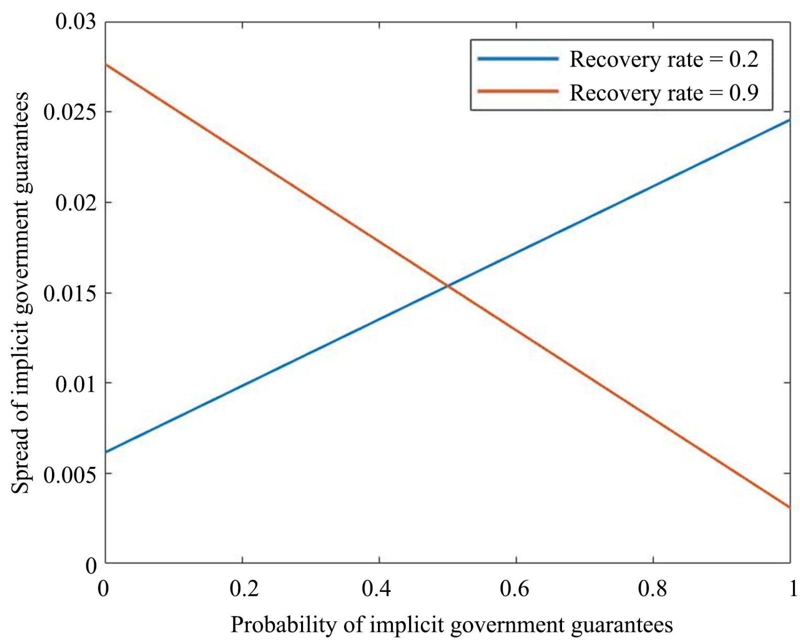

Figure 1. Probability of government intervention and price of implicit government guarantees.

According to **Figure 1**, when $\hat{R} = 0.9$, This refers to situations where the recovery rate after default is very high. it is evident that as the probability ρ of the government being willing to provide implicit guarantees increases, the credit spread of SOE bonds with implicit government guarantees gradually decreases. When ρ = 1, the government fully provides the guarantees, which implies that the implicit guarantee is equivalent to the value of a credit default swap. This finding is consistent with existing research, which suggests that implicit government guarantees reduce the financing costs for SOEs by lowering their credit spreads. But when $\hat{R} = 0.2$, it illustrates a positive and approximately linear relationship between the probability of implicit government guarantees and the corresponding guarantee spread, indicating that stronger perceived government support is associated with a larger pricing effect in the bond market.

Secondly, we analyzed the relationship between the default intensity and the pricing of implicit government guarantees. Assuming: 1) The probability of implicit government guarantees $\rho = 80\%$. 2) The discount rate is $y = 0.05$. 3) The recovery rate is $\hat{R} = 0.2$. When the default intensity λ changes from 0 to 0.2, the price of implicit government guarantees for state-owned enterprise bonds is shown in Figure 2.

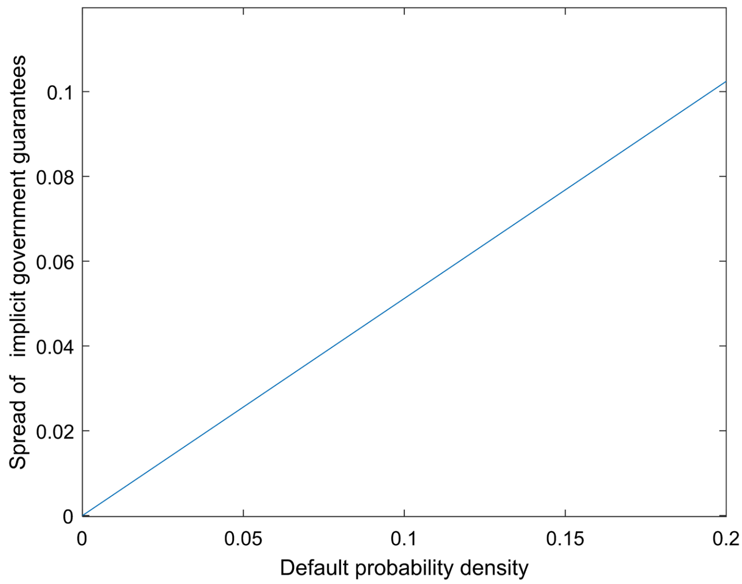

Figure 2. Default intensity and price of implicit government guarantees.

From Figure 2, it is observed that as the default intensity increases, the credit spread of SOE bonds with implicit government guarantees gradually rises. This is due to the uncertainty surrounding implicit government guarantees. As the probability of default increases with the intensity of default, the perceived risk associated with the implicit government guarantee also increases, leading to a higher price for the guarantee. Consequently, investors demand a higher credit spread to compensate for the increased risk of default, reflecting the greater uncertainty regarding the government's willingness to intervene.

Thirdly, we analyzed the relationship between the recovery rate and the pricing of implicit government guarantees. Assuming: 1) The probability of implicit government guarantees $\rho = 80\%$. 2) The discount rate is $y = 0.05$. 3) The default intensity is $\lambda = 0.03$. When the recovery rate $\hat{R}$ changes from 0 to 1, the price of implicit government guarantees for state-owned enterprise bonds is shown in Figure 3.

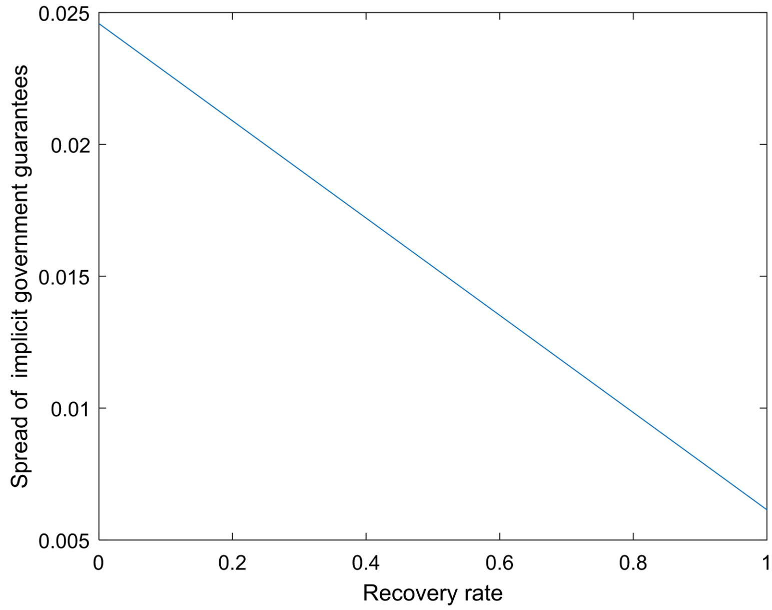

Figure 3. The recovery rate and price of implicit government guarantees.

Finally, we will analyze how the price of implicit government guarantees is simultaneously affected by the default strength and the probability of implicit government guarantee. The discount rate is $y = 0.05$ and the recovery rate is $\hat{R} = 0.9$, When the default intensity λ changes from 0 to 0.2, and the probability of governments being willing to provide guarantees changes from 0 to 1, the price of implicit government guarantees for state-owned enterprise bonds is shown in Figure 4.

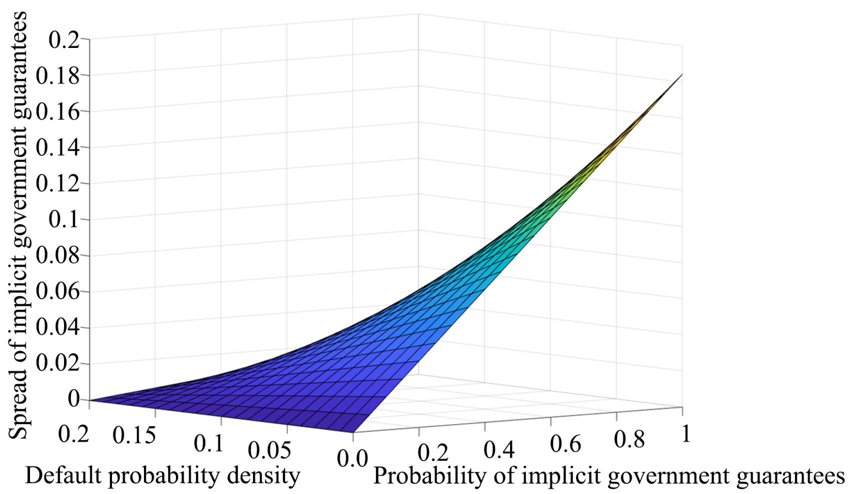

Figure 4. Price of IGGS and default strength and the probability of implicit government guarantee.

There may indeed be an inherent relationship between the default intensity and the probability of the government being willing to execute implicit guarantees. If a SOE has a higher risk of default, the likelihood of the government intervening to provide implicit guarantees may decrease, as the government may be unwilling to bear the additional risk associated with such defaults. This introduces a complex, non-linear relationship between the price of implicit government guarantees (IGGS), the default intensity, and the probability of the government executing these guarantees. As default risk increases, the perceived value of the implicit guarantee may decrease due to the government's reluctance to intervene, leading to a more intricate interaction between these variables. This complexity reflects the nuanced nature of implicit government guarantees in response to changing risk dynamics.

4. Conclusion

In this paper, we provide a logical framework for understanding the behavior of implicit government guarantees in SOE bonds. Specifically, we explain the function of implicit government guarantees from the perspective of CDS contracts and their counterparty default mechanisms. If such an implicit guarantee exists, its enforcement can be interpreted as the occurrence of a default by the seller of the CDS, thereby determining the pricing of the implicit government guarantee. Assuming the government's guarantee capacity is infinite, it becomes crucial to characterize the government's willingness to execute the implicit guarantee. This paper introduces a framework for characterizing the execution of government implicit guarantees. The research findings suggest that when the government is willing to enforce the implicit guarantee, its value aligns with the pricing of a CDS. This also provides an explanation for why the financing costs of SOE bonds are lower than those of non-state-owned enterprise bonds. Our study contributes to the theory of implicit government guarantee behavior by linking the pricing of financial instruments with government financial behavior.

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Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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