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The Application of Option Pricing Model in Financing Guarantee Rate Pricing of Small and Medium-Sized Enterprises

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Abstract: ***Financial guarantee institutions of small and medium-sized enterprises play an important supporting role in alleviating the financing problems of small and medium-sized enterprises, but the empirical pricing method and the cash flow discount method are commonly used to solve the problem of financing problems of small and medium-sized enterprises. Due to the limitations of the two pricing methods, this paper expounds the relationship between guarantee and option from the perspective of option, and points out that the guarantee contract is essentially a put option. This paper discusses how to use Black-Scholes option pricing model to determine the guarantee charge from both theoretical and empirical aspects, which provides a reference price for the reasonable determination of guarantee fee in practice.***

Keywords: Option Pricing Model, Financing guarantee, Guarantee rate

1. Introduction

The financing difficulty of small and medium-sized enterprises is a common problem in many countries, especially in our country. From the nature of the capital, the bank's capital is the pursuit of safe returns, rather than high-risk high-return. Therefore, debt or loan guarantee becomes an indispensable condition in order to encourage bank funds to support SMEs. Up to the end of 2014, there are 7989 financing guarantee institutions in China, and the balance of financing guarantee is 2.34 trillion, in which the financing guarantee of small and micro enterprises accounts for about 60%. Of course, as a commercial or third-party guarantee company, its guarantee activity is a fee service. Therefore, the charge standard of guarantee becomes a problem that must be solved reasonably.

At present, there are experience pricing and cash flow discounting in the market. But both methods have certain defects. It is difficult to reflect the positive correlation between the guarantee rate and the risk of the guarantee project theoretically, so it is necessary to find a new pricing method to redefine the rate of financing guarantee for small and medium-sized enterprises. This paper analyzes the option characteristics of financial guarantee, demonstrating that financial guarantee can apply the option pricing model, and calculates the pricing model of the financial guarantee rate according to the option pricing model.

2. The Option

Options give buyers the right to buy or sell a subject at a predetermined price at a predetermined time. As a tool to guard against financial risk, option has the particularity of financial instruments such as futures, which is different from forward contracts, that is, the rights and obligations of both parties in option contracts are not equal. The buyer of the option contract has the right to decide whether to execute or waive the right according to the change of the market, while the seller of the option contract is obliged to perform at the request of the buyer, and the seller can execute the contract when the buyer decides to give up the execution right. Such an option contract always makes it possible for the buyer to obtain benefits in the uncertain market, as the buyer of the option needs to pay a certain price for this right, that is, the option price.

According to the type of contract transaction, option contract can be divided into two types: call option and put option. A call option is the right to buy a subject and a put option is a right to sell a subject. If we use St to represent the value of the underlying asset of the T moment option, X to represent the execution price agreed in the contract, and P to express the price of the option, then the gains and losses of various options positions are shown in Table 1.

Table 1: Options position gains and losses

Option position	call option	put option
bull	M ax(St -X , 0)-P	Max(X -St , 0)-P
bear	P -M ax(St -X , 0)	P -Max(X -St , 0)

As can be seen from the above table, for the buyer of option, the biggest loss is only the royalty paid to the seller, but the profit is not capped and for the seller of the option, the biggest profit is only the royalty.

3. The Option Characteristics of Financial Guarantee

Financial guarantee is the legal act by which the guarantor provides legal protection to ensure the realization of the interests of creditors. For small and medium-sized enterprises, it is the "debtor", and the financial guarantee institution is the "guarantor". A commercial bank is a "creditor". The guarantee contract between the debtor and the guarantor is essentially an option contract. Under the security contract, if the debtor is due to repay the principal

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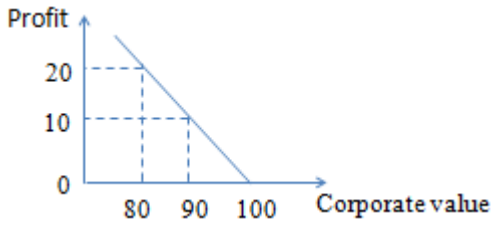
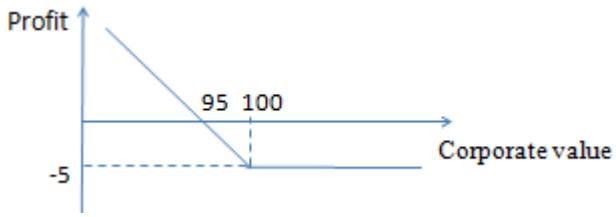
and interest of the obligation, the debtor loses only the premium paid to the guarantor. If the debtor is unable to repay the principal and interest of the debt, the guarantor must bear the compensatory liability. Since the premium received by the guarantor is far greater than the indemnity of the guarantor, the rights and obligations of the parties to the contract are manifestly unequal.

Corporate value is an important guarantee for the company to repay its debts. Therefore, when the value of the company is less than the value of the debt, the situation of insolvency will occur. If the company is liquidated, the value of the company can only be used as the basis for debt repayment, and creditors can only obtain the value of the company less than the value of the debt. Conversely, when the value of the company is greater than or equal to the value of the debt, the creditor's debt can be obtained successfully if the company is liquidated. We define "the value of the debt minus the non-negative part of the value of the company" as "the intrinsic value of the guarantee." If the value of the company is greater than or equal to the value of the debt, the intrinsic value of the guarantee is zero; if the value of the company is less than the value of the debt, the intrinsic value of the guarantee is greater than zero. As the value of the company declines, the intrinsic value of the guarantee will gradually increase until the value of the debt. Assuming that the maturing debt is 100, when the value of the company is 100, it is possible to repay the maturing debt without prior execution of the guarantee contract. But when the company value is only 90, the guarantor must bear the compensatory responsibility according to the contract agreement, the guarantee contract takes effect, the guarantee liability is 10, with the decline of the company value, the guarantee liability is increasing.



Picture 1: Guarantee profit and loss

If the guarantee fee charged by the guarantor is taken into account, the value of the pre-holding of the security contract is the difference between the value of the obligation incurred by the guarantor and the security fee paid to the surety. Assuming that the guarantee fee is 5, when the company is worth 90, the guaranteed income is 5.



Picture 2: Security gains and losses taking into account security fees

Therefore, from the option contract point of view, financial guarantee is equivalent to a put option contract. The maturity of the debt is the expiration date of the option contract, and the amount of the guarantee (the value of the debt) is the agreed price of the option. For the debtor, signing a financial guarantee contract is tantamount to buying a put option contract. To the surety, it amounts to the sale of a put option contract.

4. Option Pricing Model

Black-Scholes model deduces the formula of option pricing.

Call option pricing: $C= S_0 N(d_1)-k e^{-rt} N(d_2)$

Put option pricing: $P=C- S_0 +k e^{-rt}$

S_0 is the price when t is 0 , K is the agreed price of options, t is option maturity, N (d_1), N (d_2) are the cumulative probabilities when the variables under normal distribution are smaller than d_1 and d_2.

$$d_{1=} \frac{Ln\ (S_0/K)\ +(r_f+\sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2=d_1-\sigma\sqrt{T}$$

Annual Standard deviation with σ as the rate of return.

The option pricing model is pricing the options by constructing an equivalent asset portfolio consisting of the underlying assets and the risk-free loan assets.In the case of a guarantor, the secured contract is equivalent to the purchase of a stock option whose equivalent asset portfolio is income $x e^{-rt}$ (1 - N (d_2)), short selling 1 - N (d_1) shares.

For example a company's value is estimated to be 5 million yuan, annual volatility is 25%, and risk-free interest rate is 5%.The company currently has A and B debts, X provides general liability guarantee for A debt of 1 million yuan. If the company is unable to repay its debts at maturity, creditors can only recover from X for the balance of the company's assets that are insufficient to pay off.Y assumes a joint liability of 500 thousand yuan for B debt, that is, if the company fails to repay its debts, the creditor can recourse to the debtor or the guarantor, not subject to the order.

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Table 2: Changes in Corporate value and guarantee liability

Company value	0	50	75	100	125	150
X	100	50	25	0	0	0
Y	50	50	50	50	25	0

It can be seen that the guarantee contract signed with the company is equivalent to the right of sale at the agreed price of 1 million yuan, and the guarantee contract signed with the company is equivalent to the value of the right of sale at the agreed price of 1.5 million yuan less the value of the right of sale at a prescribed price of 500000 yuan. According to the formula of Black-Sc-holes option pricing model, the value of the X guarantee option is 1,230 and the value of the Y guarantee option is 6840.

By calculation, the company should pay X a cost of 1,230 yuan to obtain a long put option. This is also the X guarantor to assume general warranty liability required by the minimum guarantee costs. When the company is due to repay its debt, $1,230 becomes the X guarantor's premium income. When the company is insolvent, the X guarantor must compensate for the difference, and his loss may well exceed the premium income of 1,230.

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