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Design of dynamic guarantee fee based on the margin system of loans to SMEs

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ABSTRACT

As futures prices change daily, credit risk exists all the time. However, the MTM system calculates the profit and loss of each margin account everyday, and by this way, the cumulative daily price fluctuation risk is eliminated. In this research, we build a bank - security company - the company and the government-supported system, where we firstly calculate the initial guarantee fee according to VaR model, then in each time period we recalculate the guarantee fee and charge the company. Using this method, the credit risk of guarantee system is controlled effectively.

KEYWORDS

The margin System; SMEs; Dynamic guarantee fee.

Futures margin system, that day no liability system means that at the end of each trading day, the exchange settlement departments calculate the date of each futures contract settlement price, the profit and loss account for each member of each transaction amount, in order to adjust the membership margin.

DESIGN MARGIN ACCOUNT

Construction of the main part of the "bank - small technology enterprises - -Secured government subsidies Mode" margin mechanism is as follows.

Commercial banks for small and medium IT enterprises credit loans[1].

Secured financing guarantee company to undertake small technology enterprises credit loans.

The small and medium technology companies open a guarantee fee account equivalent to futures margin account in commercial banks[2].

Currently our government subsidies of government guarantees for small and medium technology companies is around 2%, equivalent to an average rate of government guarantees security agencies. But the way of the government paying government subsidies are not the same, some payments to commercial banks, some payments to guarantee companies, and even some direct payments to a small technology companies. This study follows the principle of who bears the risk of who benefits, we can regard government guarantees subsidies as the basis for the guarantee reserve, then put them into account guarantee.

Commercial banks pledge intellectual property rights of small and medium technology enterprises, put the pledge amount of financing into the guarantee fee account. As the intellectual property is difficult to convert into cash, the pledge rate of general commercial banks is about 20%-30%. This pledge rate financing facilities can not meet the financing requirements of small and medium-tech enterprises. But financing that lower this amount of financing obtained as margin collateral rate are more than rubbing. The fund is called risk reserve. The risk reserve is management by commercial banks. Commercial banks control the amount of money injected into the guarantee fee account based on the risk of loss situation of small and medium IT enterprises.

If there is no risk of fluctuations in the small and medium IT enterprises credit, guarantee corporation will extract all the reserve base, the trading margin will end; If there is risk of fluctuations in science and technology during the small business loan, the security company will extract risk reserve according to the risk of loss, the loss of the part of small and medium technology enterprises as loans along with the final repayment to commercial banks; If small technology companies can not repay breach of commercial banks and the use of credit risk reserve in the last, then the security company is to obtain intellectual property rights and pay the credit loan and used risk reserve to the commercial banks. This mechanism constantly adjusts dynamic guarantees rate[3] sbased on the risk measurement of small and medium enterprises, which simulates the margin trading futures.

VaR METHOD DESCRIBED

Model overview

VaR (Value at Risk)[4], in1993, G30 Group has published a report "derived products, practices and rules" based on the study of derivative products. They proposed measure market risk VaR (Value-at-Risk) model ("Risk Valuation" model), later launched RiskMetrics risk control model to calculate VaR by JP.Morgan. Currently, based on VaR measure financial risk has become a way to measure the size of most of the financial risk, which is widely used in foreign financial institutions. More precise, VaR represents a certain confidence level (eg 95%), The maximum loss of a financial asset or portfolio

in the next specific period of time. Math is expressed as: $P(X > VaR) = 1 - c$,where, x represents the loss of financial assets or portfolio in holding period, c is the confidence level.

A simple calculation of VaR

Consider a portfolio of financial assets, assuming its initial value P0, R is the rate of return on investment during the period, there $p = p_0(1+R)$, Under the confidence level c, assuming that the lowest value of the portfolio $P^* = P_0(1+R^*)$, Absolute VaR can be defined as $VaR = P - P^* = -P_0R^*$.

According to the above definition, computing VaR is equivalent to the calculation of the minimum P * or the minimum rate of return on R *. Assumed the probability density function of the portfolio of future returns is f (p), corresponding to the confidence level c, there

$$1 - C = \int_{-\infty}^{p^*} f(p)dp$$

Whether it obeys discrete or continuous distribution, this representation is valid. Assumed rate R of return on the investment portfolio obey normal distribution, that,R~N(μ, σ^2), $R^* = \frac{R - \mu}{\sigma}$ obey the standard normal distribution, Set $\varphi(x)$ obey the standard normal cumulative probability density, there

$$P(R \le R^*) = P(\frac{R - \mu}{\sigma} \le \frac{R^* - \mu}{\sigma}) = P(R^* \le \frac{R^* - \mu}{\sigma}) \quad \textbf{(1)}$$

If formula one equal a,that

$$P(R^* \le \frac{R^* - \mu}{\sigma}) = \alpha \text{ , there } P(R^* > \frac{R^* - \mu}{\sigma}) = 1 - \alpha \quad \textbf{(2)}$$

Introducing the concept of the side of the standard normal distribution sites, there are

$$\frac{R^* - \mu}{\sigma} = Z_{1-\alpha} = -Z_{\alpha} \quad \textbf{(3)}$$

So

$$R^* = \mu - Z_{\alpha}\sigma \quad \textbf{(4)}$$

Then

$$VaR = -P_0(\mu - Z_{\alpha}\sigma) = P_0(Z_{\alpha}\sigma - \mu) \quad \textbf{(5)}$$

If the portfolio yield of the furture obedience to independent and identically distribution, then at the same confidence level, VaR and VaR single period of time to satisfy the relationship

$$VaR_{nT} = \sqrt{n}VaR_T \quad \textbf{(6)}$$

SME DYNAMIC GUARANTEE RATE BASED ON VaR MODEL

Assume conditions

①Guarantee Period: The guarantee period is divided into n time periods, duration of each period is T, so the loan (guarantee) for a period of nT.

②Borrower corporate loans amounted to D, its opening net assets of W (mainly fixed assets and current assets, excluding intellectual property pledge), total liabilities of L.

③In the period of the loan, the borrower companies ROE R obey normal distribution, the mean and standard deviation are μ and σ.

④Risk sharing ratio of guarantee companies is I, compensatory time that security agencies pay, I = Guarantee Agency reimbursement amount / remaining amount of guaranteed loans, loans year after was r, the risk-free interest rate r0.

⑤Credit guarantee institutions capital is C, guarantees magnification M, asset liquidation value of the discount rate d, where d = liquidation value / book value

Modeling

Know from the previous assumptions, the Borrower loan amount D, guarantee period is set to n, assuming a monthly deadline unit, then the beginning of the period in paragraph i, the value of the loan amount to meet

$$A_i = D(1+r)^{(i-1)T/12}$$

We can see by the front about VaR, the borrower ROE obey normal distribution, Under the confidence level 1-a, The the maximum loss of net assets may occur as $VaR = W(Z_\alpha \sigma - \mu)$,So this time the company has net assets $W - VaR$, The first one at the beginning, consider the following two cases. If $(W - VaR - L) * d > D$, That initial liquidation value of the borrower companies is greater than the loan amount, the banks will be some probability ($1-\alpha$) that the loan guarantee safety, and the probability ($1-\alpha$) is enough big, banks can almost guarantee the security of the loan, then do not need to guarantee security agencies; if $(W - VaR - L) * d < D$, That initial liquidation value of the borrower companies is lesser than the loan amount, the bank will be unable to guarantee the security of the loan, you need to guarantee security agencies do. So the guarantee condition is $(W - VaR - L) * d > D$.

For security agencies, which bear the risk sharing ratio is I, then the i stage, under the confidence level 1-a, small technology companies to bring the risk of credit guarantee institutions is

$$\left[D(1+r)^{(i-1)T/12} - (W - VaR_i - L) \times d\right] \times \frac{DI}{D+L} \quad \textbf{(7)}$$

As the formula seven, the amount of "margin account" minimum requirements is the result. In the first one at the beginning, companies must deposit the amount of the initial,as follow $[D - (W - L) \times d] \times \frac{DI}{D+L}$, that VaR=0; In the first two, again for evaluation of its value at risk according to the consolidation of corporate, if the first two risk value greater than the first one, then the difference between both the borrower companies want to break into the account, the specific difference is

$$\left[D(1+r)^{T/12}-(W-VaR_2-L)\times d\right]\times\frac{DI}{D+L}-\left[D-(W-L)\times d\right]\times\frac{DI}{D+L}$$
$$=\left[D(1+r)^{T/12}-D+VaR_2\times d\right]\times\frac{DI}{D+L} \quad \textbf{(8)}$$

If the first two VaR is less than the first one, then the Borrower may voluntarily extra parts extracted from the account, so we can calculate each issue of the guarantee fee[5].
shown in the following table:

TABLE 1 : Dynamic cost setting indicates

n	Guarantee fee
1	$[D-(W-L)\times d]\times\frac{DI}{D+L}$
2	$[D(1+r)^{T/12}-D+VaR_2\times d]\times\frac{DI}{D+L}$
3	$[D(1+r)^{T/6}-D(1+r)^{T/12}+D+(VaR_3-VaR_2)\times d]\times\frac{DI}{D+L}$
…	…
i	$\sum_{t=1}^{i}[(-1)^{t-1}D(1+r)^{(t-1)T/12}+(-1)^{t-1}VaR_t\times d]\times\frac{DI}{D+L}, odd$ $\sum_{t=1}^{i}[(-1)^{t}D(1+r)^{(t-1)T/12}+(-1)^{t}VaR_t\times d]\times\frac{DI}{D+L}, \text{even}$

Since the guarantee rate = guarantee fee / guarantee amount, the corresponding dynamic SME guarantee rate f is

$$f=\frac{F}{D(1+r)^{(i-1)T/12}}=\frac{1}{(1+r)^{(i-1)T/12}}\sum_{t=1}^{i}\left[(-1)^{t}D(1+r)^{(t-1)T/12}+(-1)^{t-1}VaR_t\times d\right]\times\frac{1}{D+L}+\frac{1}{M}\times r_{0,}odd$$
$$f=\frac{1}{(1+r)^{(i-1)T/12}}\sum_{t=1}^{i}\left[(-1)^{t}D(1+r)^{(t-1)T/12}+(-1)^{t}VaR_t\times d\right]\times\frac{1}{D+L}+\frac{1}{M}\times r_{0,}even$$

EMPIRICAL

A Beijing high-tech company (hereinafter referred to as "a company") is principally engaged in the development, production and sale of pharmaceuticalproducts. AstheMinistryofScience,MinistryofFinanceandStateAdministration ofTaxationjointlyidentifiedthehigh-techpharmaceuticalenterprise,thepaperof"acompany"astheinsuredobjectives.

The company borrow credit facility of 10 million from a local bank, the loan date in January 2011,the period one year.

First,converse the yield of the reporting period 2006-2012 published into yield of adulthood,and then use SPSS for the annual yield of a single sample KS test, the test results are as follows

TABLE 2 : One-sample kolmogorov-smirnov test

		VAR00001
N		16
Normal Parameters[a,b]	Mean	.00526623
	Std. Deviation	.004572318

	Absolute	.218
Most Extreme Differences	Positive	.218
	Negative	-.161
Kolmogorov-Smirnov Z		.871
Asymp. Sig. (2-tailed)		.434

a. Test distribution is Normal.
b. Calculated from data.

KS test p values greater than 0.05, at a significance level of 5%, we can not reject the null hypothesis,so ROE of sample enterprises obey normally distribution, $\mu = 0.53, \sigma = 0.46$ According to the annual report 2011, its current net asset $W = 47.5129$ million, total liabilities of million a year later, $L = 33.1860$ million, In addition, by the end of 2010, lending rates of a one-year $r = 5.81\%$, guarantee institutions guarantee of magnification $M = 5$, the total secured loan of 10 million yuan, the liquidation ratio was 0.6, guarantee agencies risk ratio of 0.6, a significant level $\alpha = 0.5$, the corresponding sub-sites as 1.65.

Beginning in the first period, (a period of one month) the Borrower is required to deposit initial margin

$$[D-(W-L)\times d]\times\frac{DI}{D+L}$$

$$=[10-(47.5129-33.1860)\times 0.6]\times\frac{10}{10+33.186}\times 0.6=0.195 million$$

Guarantee fee rate : $\frac{0.195}{10\times 0.6}\times 100\% = 3.25\%$

The beginning of the second phase, companies face the risk of loss for the borrower

$$VaR_2 = 47.5129\times(1.65\times 0.00457-0.00527)=0.1079 million$$

From the above analysis, the guarantee fee of the second phase

$$[10\times(1+0.0581)^{1/12}-10+0.1079\times 0.6]\times\frac{10\times 0.6}{10+33.186}=0.076 million$$

Guarantee fee rate $\frac{0.076}{10\times(1+\frac{0.0581}{12})\times 0.6}=1.26\%$

As can be seen from the first two calculations, based on the risk of changes in each period, the company's guarantee rate per period is not the same. In addition to the guarantee fee basis, rate of corporation guarantees, on the one hand reflects the changes in credit risk after the SMEs, on the other hand, in the bank - small technology enterprises - security company - government subsidies Mode "margin mechanism reflects the variation margin deposit account, so effectively control the credit risk.

CONCLUSION

This paper stand in a new angle, introduct of futures margin system based on the establishment of a "Bank - Corporate - Guarantee Corporation guarantee system". Companies and security companies are held both long and short futures roles, warranty, guarantee companies calculate guarantee rates according to changes in the risk situation of enterprises installments. If the business is operating normally, companies can eventually repay the loan, then the risks faced by banks and security companies will naturally be eliminated along with the maturity of loans. If the deposit account deposit is charged in advance because of the risk, the guarantees company implement "forced liquidation",guarantee companies compensatory pay the loan, the risk of banks and security companies are controllable within a range of risk.

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