Analysis of Credit Risk of the State-Owned Commercial Banks Based on KMV Model

Wenjiao Lv
School of Management
Shanghai University of Engineering Science
Shanghai
China

Youchun Tang
Professor
School of China and South Korea Institute of Multimedia Design
Shanghai University of Engineering Science
Shanghai
China

Abstract

Financial markets are increasing globalization and the risks are also increasingly complex under the background of global inflation, exchange rate and interest rate sharp fluctuations. This paper in the perspective of credit risk of commercial banks, based on the KMV model, taking into account of the four state-owned commercial banks as the most abundant in Chinese financial capital. after consideration of this topic, we expected to further strengthen and improve credit risk management of the big four state-owned commercial banks.

Keywords: KMV model, Commercial Bank, Credit risks, Financial market

1、Introduction

In the modern financial environment, the commercial banks in financial markets play a decisive role. But they are also facing lots of risks, among them influence and destructive force of market risk and operational risk increased gradually in the financial environment changes, but the credit risk is still the main risk faced by banks. At present, the amount of non-performing loans in China continue to rise, the rate of bad loans has also increased. However, regardless of the future economic situation changes, the effects of the economic downturn, the domestic banking industry practically realized the importance and urgency of strengthening the management of credit risk.
In the complex financial environment, the mainly credit risk of State-owned Commercial Bank of our country is as follows:

1.1State-Owned Commercial Banks have abundant capital force, bear big credit risk proportion

With the rapid development of Chinese economy, the banking institutions changing adapt to times and the economy is also increasing. Four state-owned commercial banks are the main part of China's banking system, state-owned banking holds the most abundant financial resources, and many enterprises in China have a strong dependence on commercial banks. According to late 2013 regulatory statistics of China Banking Regulatory Commission, the total inside and outside assets of the banking financial institutions was 151.4 trillion yuan, total liabilities of the banking institutions inside and outside of 141.2 trillion yuan. Large commercial banks total liabilities 61.2 trillion yuan, total liabilities of joint-stock commercial banks 25.3 trillion yuan. From Table 1 we can see that state-owned commercial banks take more than 50% proportion.

The proportion of assets and liabilities of commercial banks in 2013

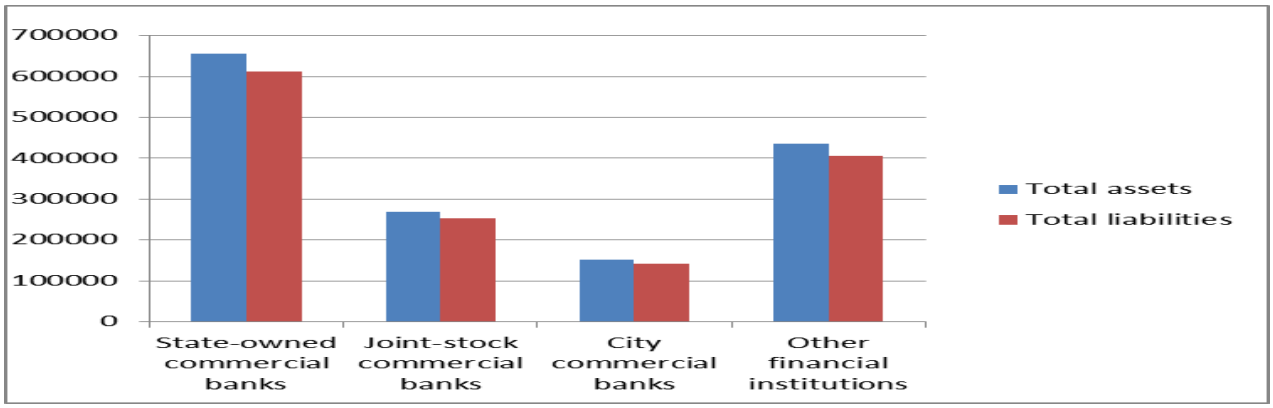

Figure1: Data Sources Chinese CBRC Statement of Assets and Liabilities

China Banking Regulatory Commission data show that in 2013, non-performing loans of commercial banks amounted to 509.1 billion yuan, up 563.6 billion yuan at the end of the third quarter, the highest point of the year 2013. As can be seen from Figure 1, the end of 2013, non-performing loans of state-owned commercial banks accounted for 60% of the risks they assume relatively large.

The commercial bank Chinese non-performing loan ratio in 2013

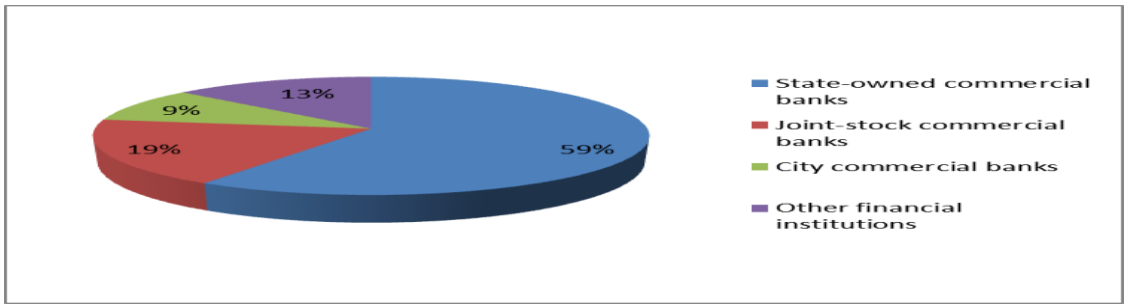

Figure 2: The Main Sources of Commercial Bank Regulatory Indicators Table

1.2 Credit Risk Management Starts Late; the Data Information is not Perfect

China's state-owned commercial banks relative to the America JP Morgan, Citigroup, HSBC and so on, is still not perfect in the development of credit risk , there is no systematic system and data support for credit risk management. The Basel Committee on banking supervision require banks to measure risk, historical data must be at least 10 years, while China's state-owned commercial banks is not satisfied. At this stage of the state-owned commercial banks of our country has been establish the credit information database in the collection and collation of the service object information, to provide all aspects of credit information and statistics, but the bank still lack the true and reliable information, even the appearance of all kinds of false information, which bring great danger to the bank's credit risk..

1.3Credit rating system is not perfect, lack of Scientific measurement model

External credit rating plays an important role for the state-owned commercial bank credit risk management , internal credit rating system in China has been initially established, but compared with the developed countries of the bank's internal system also has many defects, on the empirical study on credit risk measurement aspect, the measurement indicators is not much and mostly are financial indicators. The state-owned commercial bank mainly using the traditional method of expert scoring and calculation of the degree of credit risk, although the play a positive role, but compared with the modern method, there are still a lot of problems.

2、Using KMV Model to Analyze the Credit Risk in State-Owned Commercial Banks

2.1KMV Credit Risk Model

This paper uses KMV model, firstly, it is the KMV model based on the stock market data, reflect the enterprise knowledge information market, and can better reflect the default condition, to accurately predict credit risk uncertainty. At the same time, the KMV model of EDF is a structural model based on the Modern Corporation's financial theory and option theoretically, which is very convincing.

2.2An Empirical Analysis of KMV Model of State Owned Commercial Banks

2.2.1Data Collection

China's four major state-owned commercial banks as the model sample. The big four banks are industrial and Commercial Bank of China, construction bank, Bank of China , Chinese agricultural bank. During the period of January 1, 2013 to December 31, 2013 was studied in this thesis, the calculation benchmark for December 31, 2013, the giant network data for Shanghai board annual report 2013 and Shanghai exchange information.

Table 1: Sample Bank Financial Data

Stock code	Name of Bank	Number of shares（Million)	Total liabilities（Million）	The benchmark day closing price	Stock market （Million）
601398	BCIC	35138867.29	1763928900	3.58	125797144.9
601988	BOC	27914848.19	1291282200	2.62	73136902.26
601939	CCB	25001097.75	1428888100	4.14	103504544.7
601288	CMBC	32479411.7	1371756500	2.48	80548941.02

Data Source: giant tidal network

2.2.2The Empirical Process

(1)The value of equity volatility

Currently, the Chinese state-owned commercial banks equity division reform has been completed, the paper chosen for the total number of shares outstanding shares, its equity value = reference closing price × total share capital. According to derive the equity value of the stock on the number of returns. Because stock prices log normal distribution, the closing price of the stock price select January 4, 2013 to December 31, 2013 in. I assume Si for the i day's closing price, the stock logarithmic returns:ui=ln(Si/Si-1)

It can calculate the stock daily return standard deviation:

That is σw= $\sqrt{\frac{\sum_{i=1}^{n}\left(u_i-\bar{u}\right)^2}{n-1}}$ where u is $\bar{u}$ mean value.Annual earnings volatility

$\sigma_E=\sigma w\times\sqrt{N}$,N is a year in the number of trading days, In 2013,Number of Trading Days N=238.

Using the above formula, get daily earnings volatility and earnings volatility, The results are as shown in Table 2:

Table 2: The Value of the Stock Volatility

Stock code	Name of Bank	daily earnings volatilityσ_w	earnings volatilityσ_E
601398	BCIC	0.010967304	0.169195319
601988	BOC	0.01111202	0.171427898
601939	CCB	0.02135872	0.329506413
601288	CMBC	0.01727287	0.266472857

(2)The determination of default point (DPT)

Determination of KMV model DPT is involved in a point between current liabilities and long-term liabilities. Due to current liabilities in the bank and there is no clear statistics, this paper takes total liabilities in the financial statements as the default point [1].

[1] You Li.External credit ratings of commercial banks base on KMV Model[D].East China Normal University Thesis.

Table 3: State-Owned Commercial Banks of the Default Point

Name of Bank	DPT
BCIC	1763928900
BOC	1291282200
CCB	1428888100
CMBC	1371756500

(3)The market value of assets（V_A) and Volatility of the market value of assets(σ_A)

In the study of one-year deposit interest rate established by the People's Bank of China for the risk-free rate r = 3.25%, the debt maturity T = 1.

$$V_E = V_A N(d_1) - De^{-rt} N(d_2) \quad (1)$$

$$\sigma_E = \frac{V_A}{V_E} N(d_1)\sigma_A \quad (2)$$

其中: $d_1 = \frac{\ln\left(\frac{V_A}{D}\right) + \left(r + \frac{\sigma_A^2}{2}\right)}{\sigma_A\sqrt{t}}$, $d_2 = d_1 - \sigma_A\sqrt{t}$, $N(d) = \int_{-\infty}^{d} \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} d_x$ .In the equations, , V_E is stock market; σ_E is earnings volatility; D is the default point.Calculated using matlab software asset value V_A and asset value volatility σ_A, Shown in the following table:

Table 4: Asset Value and Asset Value Volatility

Name of Bank	V_A	σ_A
BCIC	1.8333E+13	0.0116
BOC	1.3231E+13	0.0095
CCB	1.4867E+13	0.023
CMBC	1.4084E+13	0.0152

According to the formula $DD = \frac{E(V_A) - DPT}{\sigma_A}$, EDF=[1-N(DD)] ×100%, Calculates the distance to default DD and expected default rates EDF, as follows:

Table 5: The Distance to Default and the Expected Default Rate

Name of Bank	DD	EDF
BCIC	3.2602	5.57E-04
BOC	2.5399	0.0055
CCB	1.6935	0.0452
CMBC	1.709	0.0437

3、The Empirical Results

From the above data shows that can get the conclusion:

（1）Whether a company will default to default before we are unable to judge accurately,Whether a company will default, we are unable to judge accurately before, we can only estimate the probability of default.EDF refers to the probability of bank default in the next year or several years, According to $DD = \frac{E(V_A) - DPT}{\sigma_A}$ and EDF=[1-N(DD)] ×100% know, the change of EDF is mainly influenced by the value of the assets, equity volatility and debt levels by a factor of three.

Figure 3: The distance to default and the expected default rate curve fitting

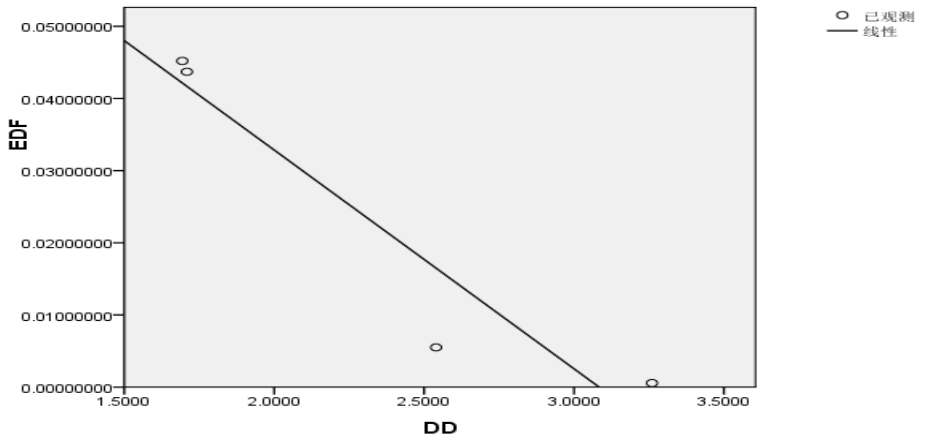

Figure 3: The Distance to Default and the Expected Default Rate Curve Fitting

（2）There will be some deviation due to the expected default rate and the actual default rate , in order to verify the relationship between EDF and DD, the use of SPSS software will default distance relationship with the expected default rate curve fitting, from Figure 3 can be seen that the curve DD and EDF inverse relationship is obvious.

（3）From the data showed that KMV model to calculate the value of EDF and the standard & poor's and moody's rating level are consistent, it indicate KMV model as a credit risk measurement method can reflect credit risk level of Banks in our country very well and it is very practical.

References

Liu Yuan. An empirical study on the bank credit risk based on Credit Risk+ model [J]Modern finance, 2011(12) .

Zhang Yun. China's commercial banks credit risk management practice research [D].Master's degree thesis of Zhejiang University, 2011.

Zheng Zhiyong. Financial quantitative analysis based on MATLAB programming [M].Beijing： Beihang University Press, 2009.

Ma Jiajie . Research on credit risk management of commercial banks in China in Post Crisis Era[J]. China Business & Trade. 2014(6).

Ceng Shihong, Wang fang. Credit Risk Assessment of manufacturing listed companies KMV Model [J]. Forecast ， 2013(2).

Zhang Nengfu,Zhang Jia. Application of modified KMV model in listing Corporation credit risk measurement in China.[J].Forecast,2010(5)

Liu Bo. Based on the credit risk KMV model to measure the China listing Corporation empirical analysis [J].Science technology and Engineering,2010,(03).

Liu Pan.Institutional Economics Analysis of credit risk of commercial banks in China [M]. Chengdou: Southwestern University of Finance and Economics press ,2008

Chen Desheng. The overall risk management of commercial bank[M]. Beijing:Tsinghua University press,2009

Mu Wentao, Chen Dianfa, Chen Ji. Commercial bank credit risk and economic capital measure under non-normal data[J]. System Engineering Theory and Practice ， 2013（6）.

Liu Fangying . China's commercial banks to explore a comprehensive risk management issues[J]. Jiangxi Social Sciences，2013（8）

Liu Kun. China's commercial banks credit risk early warning and slow-release study - based on a comprehensive risk management perspective [D], Doctoral Dissertation of University of Science & Technology China， 2013.