

Empirical Study on the Pricing of Convertible Bonds in China

—Based on B-S Option Pricing Model

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Abstract—This paper mainly describes the particularity of China's bond market, compared with the mature market in the United States, China's market is both well and bad, compared to the stock market,the advantage of the convertible bond market has the characteristics of high yield and low risk, and it has a huge space for development; The disadvantages are small convertible bonds market size, low maturity degree,and imperfect system. The article also summarizes the latest literature on convertible bonds, which can be our understanding of the latest progress in the study of convertible bonds.2017 was a year of deepening reform in China, the CSRC adjusted the issue of convertible bonds in May, and revised the measures for the administration of securities issuance ,we also explained and analyzed it. The convertible bond pricing model based on B-S option pricing model can be simulated by 28 datas, and conclude the model which simulate the value of convertible bond is better.

Keywords— Pricing of Convertible Bond;B-S model, the development process.

I. INTRODUCTION

The Shanghai Securities convertible bond price index has fallen since mid-2011. Under the dual pressure of positive shares and liquidity, the convertible bonds have fallen without falling. Debt swap is the first time to sell when the bond market funds are tight, and the A-share market has also been hit by the shortage of money:the return of financial products is rising rapidly, and the financial sector and other weighted stocks are seriously affected by the shortage of money.

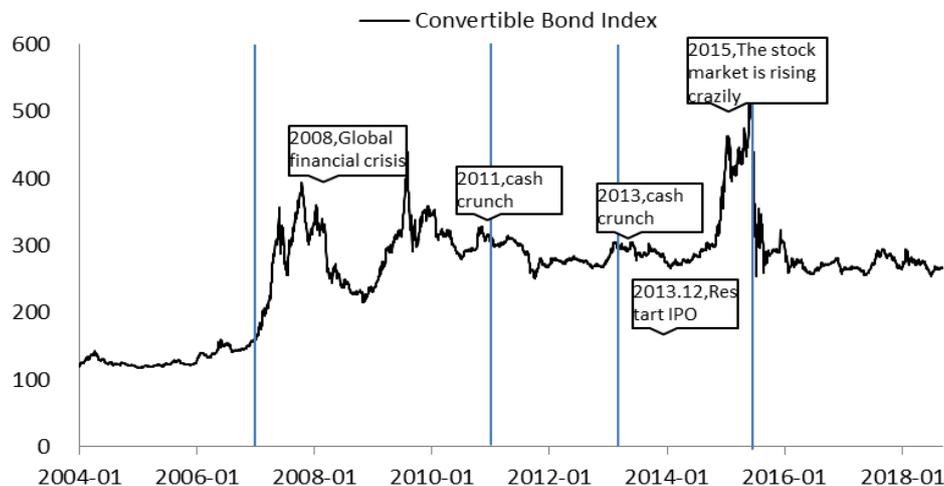


Figure 1. The Shanghai Securities convertible bond price index

On February 17, 2016, a spokesman for the SFC said that the SFC had amended some of the provisions of the Rules for the Implementation of Private Issuance of Stocks by Listed Companies and made it clear that the issuance of preferred shares, convertible bonds and micro-rapid financing of the GEM would not be affected by the new rules. The CSRC adjusted the issue of convertible bonds in 2017, and revised the measures for the administration of securities issuance.

II. ORGANIZATION OF THE TEXT

A. Valuation Method Analysis.

There are four main factors that drive the price of convertible bonds: driving factors of positive stocks; the driving force of debt; drivers of the terms; driving factors of valuation changes. Direct bond value refers to the value of convertible bonds that are about to mature and not to be convertible, and are sold directly in the market. A formula for calculating interest once a year:

$$P = \sum_{t=1}^n \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n} \quad (1)$$

P: Present value, representing the minimum value of convertible bonds; M: face value of bonds; C: annual interest; r: discount rate; n: holding years.

If the actual selling value is less than P, the holder will not choose to sell the convertible bond at a low price until maturity, but will wait until the principal and interest are recovered.

Option value means that before the maturity of convertible bonds, the holder has the right to exchange the stocks corresponding to the bonds. The value of the bond plus the value of the option constitutes the actual value of the pre-maturity convertible bond, and this value will not be lower than its lower limit of value. So before the maturity of convertible bonds, the holder chooses to buy options to exchange stocks, and the difference between the market price of convertible bonds and the lower limit of value is the option value. The acquisition of current options means the abandonment of bonds.

In order to simplify the model, the option value is regarded as the European call option price.

$$c = \left[s \cdot N(d_1) - Ke^{-rT} N(d_2) \right] \cdot 100 \div K \quad (2)$$

in $d_1 = \frac{\ln \frac{s}{K} + (r + \frac{\sigma^2}{2})T}{\sigma\sqrt{T}}$, $d_2 = \frac{\ln \frac{s}{K} + (r - \frac{\sigma^2}{2})T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$, S:the positive price, K:the convertible price, T:the remaining maturity of convertible bonds, N (.):the cumulative probability distribution function of the normal distribution, σ :the volatility, R:the continuous compound interest rate without risk.

TABLE III 28 BASIC DATA OF CONVERTIBLE BONDS

Convertible bonds	Conversion Price	Stock Price	Annual volatility(%)	Risk-free interest rate(%)	Net debt discount rate(%)	Theoretical price	Actual price
Baiyun CB	12.56	16.31	20.3032	1.50	5.2345	130.3209	129.17
Guangda CB	4.36	3.97	15.4614	1.50	5.3844	94.7850	101.15
Dianqi CB	10.65	6.84	20.7089	1.50	5.2305	94.6714	99.32
Guangqi CB	21.75	25.60	26.5090	1.50	5.2759	125.2392	122.99
14BaogangEB	42.79	52.30	23.8764	1.50	4.6867	124.6260	122.1304
Lanbiao CB	14.95	7.64	29.1556	1.50	5.2723	93.5554	104.73
Geer CB	13.04	16.98	28.8754	1.50	5.2226	139.6897	130.80
16WanxinEB	16.39	13.09	37.7214	1.50	5.2507	113.8796	102.2060
Sanyi CB	7.46	6.91	23.5684	1.50	5.2723	105.9336	106.12
15QingkongEB	16.75	12.08	24.6588	1.50	4.9416	97.2106	101.5136
17SangaoEB	10.00	6.14	24.6289	1.50	5.2832	94.8832	94.3537
16FenghuangEB	16.00	9.41	16.5510	1.50	5.2648	89.1731	93.0699
15GuoziEB	38.34	29.94	17.0989	1.50	5.2226	100.5507	107.3918
Geli CB	7.26	6.17	27.2598	1.50	5.127	106.2430	107.81
15TianjiEB	56.58	39.90	21.4484	1.50	5.1807	93.0791	104.5871
Guomao CB	8.93	8.41	26.6971	1.50	5.2723	110.7506	108.58
Jiuzhou CB	18.65	19.24	27.7379	1.50	5.2723	116.3930	117.85
Yongdong CB	30.77	23.90	42.5597	1.50	5.3987	110.6485	100.2310
15GuoshengEB	6.76	3.62	22.6738	1.50	5.2648	88.4261	92.1062
16YilingEB	17.90	16.55	23.7354	1.50	5.2390	107.6366	104.5480
Hongtao CB	10.06	6.34	30.2439	1.50	5.3017	96.4506	99.10
Hangxin CB	42.80	17.99	22.1265	1.50	5.2447	91.4940	99.77
Qimo CB	5.73	6.33	30.0095	1.50	5.2795	122.7585	115.0980
Haiyin CB	5.26	3.65	22.4701	1.50	5.2873	96.6769	99.6890
Jiangnan CB	9.41	6.96	24.8606	1.50	5.2795	98.4306	103.00
Huifeng CB	7.79	4.68	22.7214	1.50	5.2832	87.7312	99.20
Shunchang CB	9.32	8.68	38.4308	1.50	5.2759	119.2398	112.099
Luotuo CB	16.78	13.51	30.2435	1.50	5.3844	100.5285	104.02

According to the linear programming of the theoretical price and the actual price, the second figure is obtained, which shows the degree of deviation of the theoretical price from the actual price.

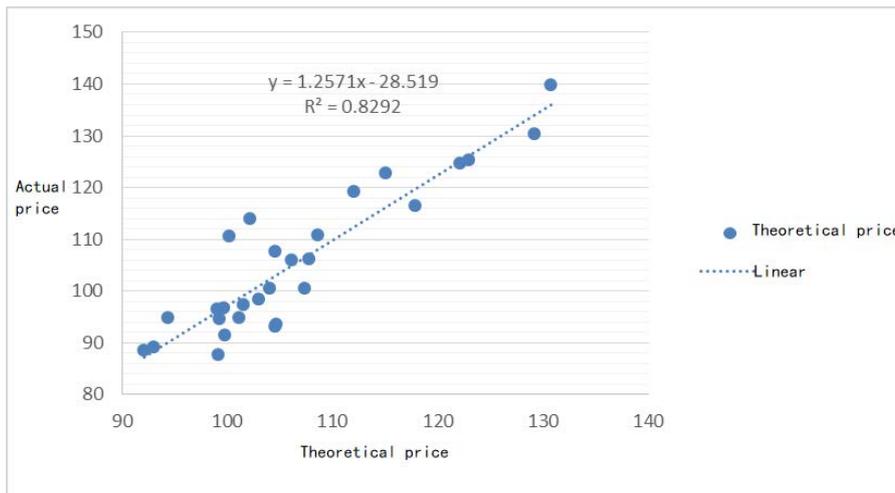


Figure 2. Linear relationship between theoretical price and actual price

III. LITERATURE REFERENCES

Brennan and schwartz[5]first proposed to apply option method to the pricing of convertible bonds, and decomposed its value into the sum of ordinary bonds and European warrants. A two-factor pricing model with Vasicek interest rate model was established. By solving differential equations, Brennan and Schwartz[6] proposed a finite difference pricing method. Cox, Ross and Rubinstein[2]based on risk neutral theory and numerical method, two fork tree pricing model is established. When Longstaff and schwartz[3] pricing financial products with implied American options, the least square Monte Carlo simulation method is proposed to estimate the expected function of each period. Tsiveriotis and Femadez[4]proposes a two-part valuation model that divides convertible bonds into two parts, which occur when bonds eventually become stocks and bonds eventually become liabilities.Chenxi Fan et al.[1]Based on China's convertible bond market data from 2002 to 2013, three convertible bond models are compared: constant volatility model, stochastic volatility model and jump-diffusion model. The stochastic volatility model is more suitable for the Chinese market than the other two models.

IV. SUMMARY

Convertible bonds in China's securities market has only developed for more than ten years. Although they have grown rapidly, there are some loopholes and misunderstandings in the process of development because of the lack of environment and foundation. China is now facing the process of deepening reform, the development of convertible bond market undoubtedly plays a great role in the optimization of corporate structure, and can enhance the innovation of China's financial market.

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