

Research on RIVM Derivative Model based on Shell Resources

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Abstract. With the further development of China's financial reform, the importance of stabilizing capital market is gradually highlighted. The volatility of China's A-share market is significantly higher than that of developed countries. After analyzing the causes of the large fluctuations in stock market, this paper puts forward a simple valuation model of A-share market, which is easy to understand and quantify. It will provide investment reference for small and medium-sized investors in order to increase the rationality of their investment. Based on the classical RIVM derivative model, considering the shell resource value of China's A-share market, the new valuation model is logically introduced. The results show that the decline rate of equity value is small, and the equity value decreases with the decline of asset-liability ratio when the asset-liability ratio is much less than 100%; The decline rate of equity value increases sharply, and equity value decreases rapidly with the increase of asset-liability ratio when the asset-liability ratio is close to 100%.

Keywords: RIVM derivative model; shell resources; equity valuation; valuation model.

1. Introduction

In the process of promoting RMB internationalization, Chinese government must stabilize the financial market. As a branch of financial market, the stability of capital market is very important. At present, individual investors in China's A-share market account for a large proportion in the whole market, which leads to an obvious "Herd Effect" in the whole market, leading to the volatility of A-share market significantly higher than that of developed countries, which is not conducive to the stability of financial market.

The main investments in China's A-share market include small and medium-sized individual investors, hot-money private equity institutions, public funds and state investment institutions. Most of the individual investors are non-professional investors, lacking basic knowledge of financial analysis and valuation. These characteristics make them more inclined to follow the technical and emotional side of short-term operation in investment. Hot-money private equity institutions make use of the characteristics of small and medium-sized individual investors to make various kinds of speculation, and use the "Herd Effect" of small and medium-sized individual investors to speculate and make profits. However, researchers of securities companies are greatly influenced by market sentiment when analyzing stocks. In many cases, they cannot make rational and independent analysis, and then give reasonable target prices to guide the market.

As for the research on valuation model, previous researchers have done the following works:

Yuan Lin and Liao Xiaopeng (2009) analyzed the main explanatory factors of the stock price in China's A-share market based on Feltham-Ohlson Model, and concluded that the explanation of the stock price by book net assets in China's capital market has been increasing year by year.

Li Yao (2016) selected the relative valuation indicators of P/E Ratio and Net Market Rate which are easy to use by investors, and used factor regression analysis to conclude that P/E Ratio is more reliable than Net Market Rate in intrinsic value analysis.

On basis of analyzing the Residual Income Valuation Model, Zuo Yifan (2016) combined DuPont analysis method to decompose and deduce, and get a valuation model which combined stock value with enterprise accounting information well.

On basis of introducing and evaluating the existing stock valuation theories, Chu Zhiwen (2013) selected the valuation methods that fitted the current situation of A-share market and improved them in order to enhance the ability of the model to explain the stock price. Moreover, he conducted experiments and tests on the improved model based on the actual market data, and achieved good results.

Sun Yihua (2016) started from the traditional stock valuation model and combined with the specific data of Chinese listed companies, analyzed the applicability of the valuation method in order to point out the direction for improving the valuation model.

2. RIVM Derivative Model

RIVM derivative model estimates the bottom price of each stock by using the specific indicators of each stock, such as net assets per share, return on net assets, asset-liability ratio and total equity, combined with dynamic market indicators such as shell value and nominal interest rate.

RIVM derivative model helps small and medium-sized investors to make quantitative analysis to assist in their stock investment and increase their confidence in holding stocks by the way of simple investment ideas and convenient parameter acquisition, at the same time, it promotes the guidance of A-share market value investment, thus increasing the stability of the market.

Suppose that investor A holds M-unit currency and plans to invest his money in a securities asset that he can choose to invest at risk-free rate of r , or invest in a company whose stock price is P , net asset is B_V and return on net asset is ROE. It calculates the rate of return a year later, $R_r = \frac{ROE \times B_V}{P}$. Suppose that there is no risk-free arbitrage opportunity in a strong efficient market,

there should be $R_r = r$, in this way, we can inversely deduce the price of the stock when investor A buys it.

Given that there are two companies A and B in market:

Table 1. Comparisons between Company A and Company B

Company name	Net assets	Return on net assets	Asset-liability ratio
Company A	$B_V(a)$	$ROE(a)$	$ALR(a)$
Company B	$B_V(b)$	$ROE(b)$	$ALR(b)$

Given that $B_V(a) = B_V(b)$, $ROE(a) = ROE(b)$, $ALR(a) > ALR(b)$, how should investor A decide which company to buy? In the case of the same ROE, the larger the ALR is, the higher the risk is. Investor A is bound to choose the smaller ALR.

According to this logic, when investor A buys shares, the price is:

$$P = \frac{B_V \times ROE}{r} \times k \quad (1)$$

Among them, k is the risk discount function of the asset-liability ratio.

The classical RIVM derivation model (when $N=1$) assumes:

Firstly, the hypothesis that there is no risk-free arbitrage. It shows that there are no portfolio assets in the market at any given time that have a positive return without initial investment.

Secondly, the hypothesis that ROE is greater than zero. It indicates that when ROE is less than or equal to zero, the estimated value is negative, which is inconsistent with conventional logic. That is, RIVM derivative model is not applicable for valuation when roe is less than or equal to zero.

The basic formula of classical RIVM derivative model (when $N = 1$):

$$P = \frac{B_V \times ROE}{r} \times k \quad (2)$$

Among them, B_V is net assets per share; ROE is return on equity; r is nominal market interest rate; k is risk discount coefficient.

In China, IPOs are issued under the approval system, which makes listing qualifications a scarce resource, and then there are those listed companies whose net assets are zero but the market value of stocks is still more than one billion. The market value of these "shell shares" is equivalent to the price at which the listed companies in the "A shares" are listed.

From this perspective, the classical RIVM derivative model is transformed into:

$$P = \frac{B_v \times ROE}{r} \times k + \frac{V(Shell)}{N(Total\ equity)} \quad (3)$$

Among them, B_v is net assets per share; ROE is return on equity; r is the nominal market interest rate; k is risk discount coefficient; $V(Shell)$ is the price of listing qualification; $N(Total\ equity)$ is the total share capital of the listed company in A shares.

Under the conditions of market economy, the determination method of market interest rate is expressed as follows:

$$r = r^* + RP = r^* + IP + DRP + LRP + MRP \quad (4)$$

Among them, r is the market interest rate; r^* is the pure interest rate; RP is risk premium; IP represents inflation premium; DRP is default risk premium; LRP represents liquidity risk premium; MRP is term risk premium. The details are as follows:

Firstly, in the model, ROE is the return on net assets value of an accounting year. According to the same time unit in the ratio relationship of $\frac{ROE}{r}$, the time unit of the nominal market interest rate r is one year.

Secondly, in the model, ROE represents the rate of return on purchasing a listed company, and the stock price includes the required price to obtain ROE of a specific listed company. Because stocks are sustainable securities and the stock market has great liquidity, it can be concluded that the return of listed companies expressed by ROE does not include default risk premium, liquidity risk premium and term risk premium, and the nominal market interest rate r does not include default risk premium, liquidity risk premium and term risk premium according to the principle of the same unit in the ratio relationship of $\frac{ROE}{r}$.

Therefore, the nominal market interest rate in RIVM derivative model is determined as:

$$r = r^* + IP \quad (5)$$

In the operation of enterprises, the enterprises with unstable future cash flow and high sensitivity to economic shocks will fall into financial distress, financial crisis and even bankruptcy if they use too much debt. Therefore, liabilities not only bring tax-deduction benefits to enterprises, but also bring the cost of financial distress to enterprises.

Trade-off Theory emphasizes the optimal capital structure for maximizing the value of an enterprise on basis of balancing the tax-deduction benefits of debt interest and the cost of financial distress. And the debt ratio determined at this time is the present value of the marginal value of debt deduction benefits equal to the increased cost of financial distress.

Based on the revised proposition of MM theory, the value of indebted enterprises is the present value of the value of indebted enterprises plus tax-deduction benefits. The expression is:

$$V_L = V_U + PV(Tax\ credit) - PV(Cost\ of\ financial\ distress) \quad (6)$$

Among them, V_L represents the value of the indebted enterprise; V_U represents the value of the debt-free enterprise; $PV(Tax\ credit)$ represents the present value of the interest tax credit; $PV(Cost\ of\ financial\ distress)$ represents the present value of the cost of financial distress.

The expression of Trade-off Theory is shown in the figure:

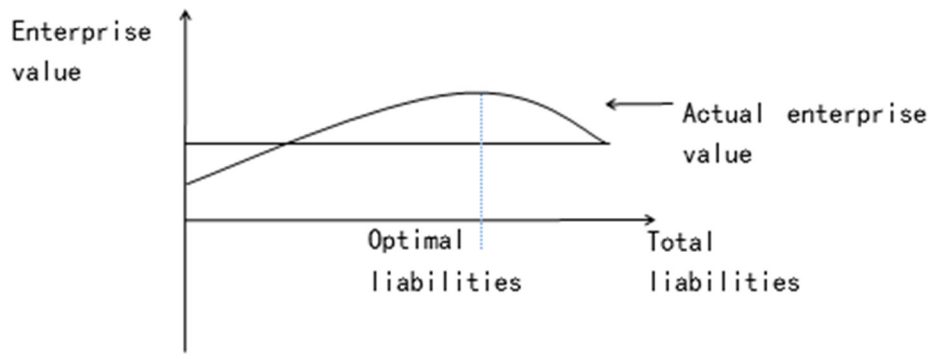


Figure 1. The Diagram of Tradeoff Theory

The relationship between enterprise value and equity value is as follows:

$$\text{Enterprise Value} = \text{Equity Value} + \text{Enterprise Liabilities} + \text{Preferred Shares} + \text{Minority Shareholder Equity} - \text{Cash and Investment} \quad (7)$$

By identical transformation, it is obtained that:

$$\text{Enterprise Value} = \text{Equity Value} - \text{Enterprise Liabilities} - \text{Preferred Shares} - \text{Minority Shareholder Equity} + \text{Cash and Investment} \quad (8)$$

According to Trade-off Theory, enterprise value is a function expression of enterprise liabilities, which can be obtained by substitution:

$$\text{Enterprise Value} = f(\text{Equity Value}) - \text{Enterprise Liabilities} - \text{Preferred Shares} - \text{Minority Shareholder Equity} + \text{Cash and Investment} \quad (9)$$

According to RIVM Derivative Model Formula $P = \frac{B_v \times ROE}{r} \times k$, it can be concluded that:

$$\text{Equity Value} = EV = P = \frac{B_v \times ROE}{r} \times k \quad (B_v \text{ represents net assets}) \quad (10)$$

$$\begin{aligned} \text{Enterprise Liabilities} &= \frac{\text{Total Liabilities}}{\text{Total Assets}} \times (\text{Total Liabilities} + \text{Net Assets}) \\ &= \text{Asset - Liability Ratio} \times (\text{Total Liabilities} + \text{Net Assets}) \end{aligned} \quad (11)$$

Bring equation (10), (11) into equation (9):

$$\frac{B_v \times ROE}{r} \times k = f[ALR \times (GL + B_v)] - ALR \times (GL + B_v) + \mu \quad (12)$$

Among them, B_v represents net assets; ALR represents asset-liability ratio; GL represents total liabilities; μ represents (Cash and Investment - Minority Shareholder Equity - Preferred Stocks).

By separating parameters, it can be concluded that:

$$k = \frac{r}{ROE \times B_v} \times \{f[ALR \times (GL + B_v)] - ALR \times (GL + B_v) + \mu\} \quad (13)$$

$$\text{And } ALR = \frac{GL}{GL + B_v} \Rightarrow \frac{GL}{B_v} = \frac{ALR}{1 - ALR} \quad (14)$$

Bring formula (14) into formula (13), after simplification, it can be concluded that:

$$k = \frac{r}{ROE} \times \left(\frac{f[ALR \times (GL + B_v)]}{B_v} - \frac{ALR}{1 - ALR} \right) \quad (15)$$

By formula (9), it can also be concluded that, under the framework of trade-off theory, both equity value and enterprise value are functional expressions of enterprise liabilities, and there is a multiple relationship between equity value and net assets of enterprises.

Formula (15) can be approximately expressed as

$$k = \frac{r}{ROE} \times \left(a - \frac{ALR}{1 - ALR} \right) \quad (16)$$

By identical transformation, formula (15) can be transformed into:

$$k = \frac{r}{ROE} \times \left(a + 1 - \frac{1}{1 - ALR} \right) \quad (17)$$

It is represented by simple graphics:

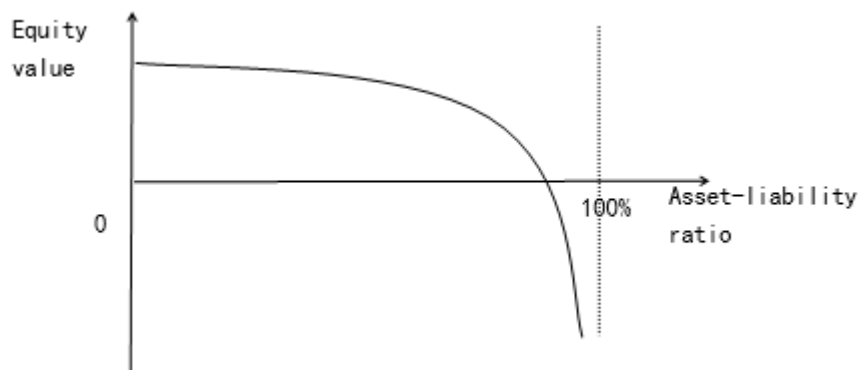


Figure 2. Diagram of RIVM Derivative Model

It can be concluded by formula (17) and graphic description that When the asset-liability ratio is far from the 100% area, the absolute value of the curve slope is small, and the equity value decreases with the decline of the asset-liability ratio; When the asset-liability ratio is close to 100%, the absolute value of the curve slope is large, and the equity value decreases rapidly with the increase of the asset-liability ratio.

3. Conclusion

Based on the classic RIVM derivative model, considering the shell resource value of China's A-share market, the new valuation model is logically introduced. The results show that the decline rate of equity value is small, and the equity value decreases with the decline of asset-liability ratio when the asset-liability ratio is much less than 100%; The decline rate of equity value increases sharply, and equity value decreases rapidly with the increase of asset-liability ratio when the asset-liability ratio is close to 100%.

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References

- [1]. Gu Fengjuan, Jin Dehuan. Analysis on the Impact of Fundamentals and Funds on the Volatility of China's Stock Market. *Shanghai Finance*, 2012 (10), p. 85-91.
- [2]. Yuan Lin, Liao Xiaopeng. The Usefulness of Investment Decision-making of Earnings per Share and Net Assets per Share: An Empirical Study Based on "Feltham-Ohlson Valuation Model" . *Journal of Beijing University of Industry and Commerce*, 2009 (01), p. 35-40.
- [3]. Li Yao. Empirical Comparison of Valuation Effectiveness of P/E Ratio and P/N Ratio . *Times Finance*, 2016 (10), p. 255.
- [4]. Zou Gaofeng, Zhang Wei, Wang Hui. IPO Valuation, First-day Earnings and Long-term Performance . *System Engineering Theory and Practice*, 2015, (04), p. 828-836.
- [5]. Han Fei, Chen Feng. Brief Analysis on the Combination of Basic Analysis and Technical Analysis. *Modern Economic Information*, 2016, (22), p. 267.
- [6]. Gao Han. Analysis of IPO Underpricing at Home and Abroad. *Cooperative Economy and Technology*, 2017, (01), p.44-45.
- [7]. For the people, Niu Yulong, Wang Frog. Corporate Fundamentals, Market Behavior and Stock Investment Returns. *Journal of Chongqing University of Technology (Social Science)*, 2017, (01), p. 67-75.
- [8]. Chen Yongling. Analysis and Empirical Study on the Underpricing Factors of Domestic New Stocks. *Operating Manager*, 2017, (05), p. 38.
- [9]. Xue Zhiguo. Wave Theory is a Description of Investor Sentiment. *China Market*, 2017, (06), p. 30-31.
- [10]. Huang Shunwu, Jia Jie and Wang Wenjun. Research on IPO Underpricing Decomposition Based on Bilateral Stochastic Boundary Model: Evidence from GEM in China. *China Management Science*, 2017, (02), p. 21-29.