

3. Chain Performance. *International Journal of Operations and Production Management*, p.p.275-292.
4. P. C. Brewer, T. W. Speh (2000) Using Balanced Scorecard to Measure Supply Chain Performance. *Journal of Business Logistics*, p.p.75-93.
5. J. A. Roger (1999) Measurement for Measure. *Logistics*, p.p.111-113.
6. J. D. Camm, T. E.(1997) Chorman. Blending OR/MS. *Judgment and GIS: Restructuring P&G's Supply Chain*, p.p.128-142.



## Analysis of Stock Market Value Based on Equity Valuation

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### Abstract

This paper uses data of smelting industry of ferrous metal in stock market to check the explanatory capacity of mathematical model of modern residual income on Chinese stock price, and adopts  $cr_{10}$  as the substitution variable of non-accounting information variable  $v$  and CAPM model to calculate the capital cost. Choose 2% and 6% respectively as the risk premium, taking into consideration the influence of capital cost difference of the model. The analysis shows that the explanatory capacity of the residual income model on stock price is better than that of the residual income model derived from the assumption of linear information dynamic excluding net asset.

Key words: EQUITY VALUATION, RESIDUAL INCOME MODEL, CHINESE STOCK MARKET

### 1. Introduction

Equity valuation is a big theoretical issue [1-2]. The rapid development and inflation of global stock market has exacerbated the trend of asset bubble,

which makes the bubble explanation and research an urgent task of the financial theory research in the new century. The equity valuation is the beginning and an important composition in the bubble research of stock

market [3]. Only if the equity value is measured accurately, can the bubble research be carried out. The equity valuation can reduce the fluctuation of stock market and financial risk [4-6]. When an economic manager formulates financial policy, he/she must know the valuation level of stock market and avoid formulating the wrong policy, which will intensify the situation and exacerbate the financial risk [7]. The equity valuation is the key for the investor to succeed. Greed and fear are the enemies of investment in the stock market. Herd Effect of the organization investors and Pursuit Risen up and Abandon Got down of individual investors reflect the greed and fear directly [8-9]. The best solution of bidding farewell to greed and fear is to calculate the stock value directly and insist on value investment, namely when the market price is higher than the value, sell out the stock; and when the market price is lower than the value, buy in the stock [10-12]. The equity valuation is the first step, and also the most important step for successful investment in the stock market.

The traditional equity valuation methods are dividend discount model and discounted cash flow model etc. These two valuation models have three fatal defects. Firstly, the data used by both valuation models are future values. When people make actual valuation, they need to predict the operation condition and data of the enterprise in the future. Under uncertain conditions, it is hard to estimate the operation situation of enterprises in the future accurately and the valuation error is usually huge. Secondly, infinite summation formula exists in both valuation models. The existence of infinite summation formula prevents the classical econometric method from checking the authenticity of models; meanwhile when people calculate the stock value, they have to choose a cross section and form a truncation error. Thirdly, the valuation information used by both valuation models is too little, which does not take full advantage of the data in the accounting statements. The research of concept of modern accounting information demonstrates that net asset; earnings per share, accounting accrued items etc. all contain plenty of useful valuation information. How can these accounting data be integrated into the equity valuation model? The modern residual income model proposed by Accounting Scholar Ohlson overcame the above three defects of dividend discount model and the discounted cash flow model. Residual Income, RI refers to the residual value after enterprise earnings minus normal capital cost. Residual income = enterprise earnings – capital cost of enterprise. The residual income model refers to the equity valuation model of measuring stock value through accounting

net asset and residual income. The residual income model can be stated as: stock value = accounting net asset + sum of present value of residual income. Ohlson thinks that during the actual economic activities, because of the existence of market competition, the residual income of enterprise will follow mean reverting process and the enterprise cannot receive the income exceeding average market level for a long time. Ohlson describes this thought as assumption of linear information dynamic, namely the residual income equals the sum of its lag item and other non-accounting information variable  $v$ . Through mathematical transformation, the stock value finally can be expressed as the algebraic sum of the accounting net asset, current residual income and non-accounting information variable  $v$ .

This paper researches on the difference of explanatory capacity of the modern residual income model on stock price, and checks modern residual income model, model of free cash flow of equity and surplus capitalization model.

### 2. Mathematical Model of Modern Residual Income

The future cash flow of the listed companies in the smelting industry of ferrous metal is divided into two stages. At the first stage, the cash flow increases continuously. At the second stage, the cash flow remains unchanged. We assume that the cash flow of the company at the first stage increases 5% annually, and then the growth years have two scenarios. One is increasing for 5 years and the other is increasing for 10 years. Why assuming the growth rate of cash flow of 5% is that according to the development plan in several years in the future by Chinese government, Chinese annual GDP growth rate in the next 15 years is about 5-7%. The smelting industry of ferrous metal is a cyclical industry highly connected with macro economy. As a result, it is reasonable to assume that the smelting industry of ferrous metal has the same growth rate as GNP. Additionally, along with the intensification of development of Chinese national economy and implementation of environmental protection measures, the consumption of ferrous metal will be reduced and the growth rate of the industry will be lower than that of GDP. As a result, we assume that the future annual growth rate of cash flow of the smelting industry of ferrous metal is 5%, a little bit lower than the annual growth rate of GDP in the future. After the first stage ends, during the second stage, we assume that the annual cash flow of the smelting industry of ferrous metal remains unchanged (All date used in this paper are data per share. Here it refers to the cash flow per share.), forming the terminal value of per-

petuity.

When modern residual income model is used to calculate the internal value of stock, according to different theoretical hypothesis proposed by Ohlson at different periods, this paper adopts the following five modern residual income valuation models to calculate the internal value of stock.

$$\text{LID1: } x_{i+1}^\alpha = \omega_1 x_i^\alpha + \omega_2 cr10_i + \varepsilon_{i+1}$$

$$\text{Herein, } \alpha_1 = \frac{\omega_1}{1+r-\omega_1}$$

$$\alpha_2 = \frac{1+r}{(1+r-\omega_1)(1+r-\omega_2)}$$

$$\text{LID 2: } x_{i+1}^\alpha = \omega_0 + \omega_1 x_i^\alpha + \varepsilon_{i+1}$$

$$\text{Herein: } \alpha_0 = \frac{(1+r)\omega_0}{(1+r-\omega_0)(1+r-\omega_1)}$$

$$\alpha_1 = \frac{\omega_1}{1+r-\omega_1}$$

$$\text{LID 3: } x_{i+1}^\alpha = \omega_1 x_i^\alpha + \omega_2 bv_i + \varepsilon_{i+1}$$

$$\text{Herein: } \alpha_1 = \frac{\omega_1}{1+r-\omega_1}$$

$$\alpha_2 = \frac{(1+r)\omega_2}{(1+r-\omega_1)(1+r-\omega_2)}$$

$$\text{LID 4: } x_{i+1}^\alpha = \omega_0 + \omega_1 x_i^\alpha + \omega_2 bv_i + \varepsilon_{i+1}$$

$$\text{Herein: } \alpha_0 = \frac{(1+r)\omega_0}{(1+r-\omega_1)(1+r-\omega_0)}$$

$$\alpha_1 = \frac{\omega_1}{1+r-\omega_1}$$

$$\alpha_2 = \frac{(1+r)\omega_2}{(1+r-\omega_1)(1+r-\omega_2)}$$

$$\text{LID 5: } x_{i+1}^\alpha = \omega_0 + \omega_1 x_i^\alpha + \omega_2 x_{i-1}^\alpha + \varepsilon_{i+1}$$

$$\text{Herein: } \alpha_0 = \frac{(1+r)^2 \omega_0}{[(1+r)^2 - \omega_1(1+r) - \omega_2]r}$$

$$\alpha_1 = \frac{(1+r)\omega_2}{(1+r)^2 - \omega_1(1+r) - \omega_2}$$

$$\alpha_2 = \frac{(1+r)\omega_1 + \omega_2}{(1+r)^2 - \omega_1(1+r) - \omega_2}$$

### 3. Sample Choosing and Data Disposal

Use the data of the listed companies of smelting

**Table 1.** Valuation Comparison of Modern Residual Income Model under Assumption of Different LID when Risk Premium is 2%

Ticker	stock abbreviation	P	LID1-V1	V1-ERR	LID2-V2	V2-ERR
569	GreatWall	1.89	8.354429	-3.42033	1.322123	0.300464
629	G new steel vanadium	5.12	15.9961	-2.12424	11.57749	-1.26123

industry of ferrous metal in China from 1996 to 2005. Substitute the financial data of the listed companies in year 2004 into each valuation equation and calculate the stock value of listed companies estimated by each valuation model; finally compare the estimated value with the actual price of listed companies at the end of June 2005, and calculate the relative error of the two  $Err = (V - P) / P$ . Compare the relative explanatory capacity of stock price influenced by each model.

Among the listed companies in the smelting industry of ferrous metal in China, Jinan Steel came into the market in year 2004. Without financial data of year 2003, Jinan Steel was removed from the sample. There are totally 29 companies left in the end. When calculating residual income, the equity capital cost is obtained by CAPM formula. According to CAPM model, the capital cost can be shown as:

$$r_i = r_j + \beta_i \times Risk\ premium$$

The risk premium uses 2% and 6% respectively. For risk-free interest rate, use interest rate of individual (enterprise) fixed deposit of 1 year. Because China started charging interest tax since November 1999, the income tax of deposit interest of 20% deducted should be additionally considered for 1-year fixed deposit after November 1999. In discounted cash flow model, the beginning cash flow is CF and uses mean value in year 1996 to 2003. In the surplus capitalization model, the surplus per share still uses the mean value in year 1996 to 2003. When adopting the discounted cash flow model and surplus capitalization model, the capital cost used is the expected rate of return in the future. According to the convention of theoretical research, we assume that the expected rate of return in each year in the future of every company is the same, and the detailed expected rate of return is obtained by CAPM formula.

### 4. Comparison of Explanatory capacity of Each Residual Income Model

In order to overall explore Chinese capital market, we choose the residual income with capital premium of 2% and 6% respectively to analyze. Table 1 is the comparison of explanatory capacity of each residual income valuation model formed by assumption of different information dynamic when the capital premium is 2%.

708	Daye special steel	2.94	7.355659	-1.50192	2.010278	0.316232
709	G Tang Gang	3.7	17.42643	-3.70984	11.53005	-2.11623
717	G Shao steel	5.69	20.43174	-2.59082	17.29657	-2.03982
761	Wood steel sheel	4.19	15.31343	-2.65476	11.12566	-1.65529
825	Taigang stainless stocks	3.77	16.82071	-3.46173	12.67412	-2.36183
898	G An steel	3.7	16.38062	-3.4272	9.689319	-1.61873
959	G Shou steel	3.35	15.46672	-3.61693	7.857123	-1.34541
961	Dalian Taurus	2.86	9.115734	-2.18732	3.463117	-0.21088
600001	Handan iron and steel	4.88	17.98775	-2.68601	12.20263	-1.50054
600005	G Wu steel	3.4	14.00095	-3.11793	6.837023	-1.01089
600010	Steel shares	3.99	17.3735	-3.35426	11.62689	-1.191401
600019	G Bao steel	4.98	20.06458	-3.02903	12.63198	-1.53654
600102	Vegetable Steel shares	4.56	20.08794	-3.40525	13.69384	-2.00304
600117	Xining special steel	2.95	10.15554	-2.44256	4.00108	-0.3563
600126	Hangzhou Iron and Steel shares	4.86	21.67065	-3.45898	16.50785	-2.39668
600231	Ling Steel shares	4.72	16.77336	-2.55368	13.01222	-1.75683
600282	South Steel shares	3.39	20.66716	-5.09651	15.73606	-3.64191
600307	Alcohol steel hongxing	4.73	21.46974	-3.53906	16.29643	-2.44534
600357	G bearing vanadium and titanium	2.94	11.47186	-2.90199	5.862095	-0.99391
600399	Fushun special steel	4.55	9.945682	-1.18586	2.286049	0.497572
600569	Anyang iron and steel	2.66	11.9966	-3.51	6.306742	-1.37096
600581	Eight one iron and steel	3.95	17.75518	-3.49498	12.37399	-2.13266
600691	ST East Carbon	1.93	4.997784	-1.58953	1.112408	0.423623
600714	Rui mining	4.31	9.468414	-1.19685	2.129946	0.505813
600804	Dr. Peng	3	4.893107	-0.63104	1.566994	0.477669
600808	Horse Steel shares	3.03	16.82275	-4.55206	8.9332	-1.94825
600894	Wide Steel shares	2.24	11.41354	-4.09533	4.28701	-0.91384
The average		3.733793	14.54061	-2.91503	8.825872	-1.24171

In Table 1, LID1-V1, LID2-V2, LID3-V3, LID4-V4 and LIDS-VS indicate the theoretical value of stock calculated by residual income model derived from assumption of linear information dynamic LID1, LID2, LID3, LID4 and LIDS respectively. V1-ERR, V2-ERR, V3-ERR, V4-ERR and VS-ERR express relative error between theoretical value and actual price. As can be seen, the residual income models in all forms overestimate the value of stock in year 2005. Herein, the valuation equation assuming the residual income follows the second-order autoregressive procedure has the biggest error, which is 8.82 times overestimated as a whole. LID3 and LID4 models, assuming the valuation model with residual income concerning net asset, have the smaller error relatively.

### 5. Conclusion

The results show that the residual income models in all forms overestimate the stock value. The main reason is that year 2003 and 2004 were the peak for the smelting industry of ferrous metal in China. The

residual income during these two years increased greatly. The estimated theoretical value of stock also increased largely, turning up overvaluation. In each form of the residual income models, the explanatory capacity to stock price of residual income model derived from assumption of linear information dynamic of net asset is the highest. As a result, the influence of net asset on the residual income should be taken into account in the Chinese Market. We adopted the risk premium of 2% and 6% respectively to calculate the capital cost, and found that risk premium of 6% was more aligned with the situation in the Chinese market at that time in year 2004 and 2005.

### References

1. Antonio F. Galvao, Gabriel Montes-Rojas (2015) On Bootstrap Inference for Quantile Regression Panel Data: A Monte Carlo Study. *Econometrics*, 3(3), p.p. 654-666.
2. Guido Ascari, Argia Sbordone (2014) The Macroeconomics of Trend Inflation. *Journal of Economic Literature*, 52(3), p.p. 679-739.

3. Paulina Oliva (2015) Environmental Regulations and Corruption: Automobile Emissions in Mexico City, *Journal of Political Economy*, 123(3), p.p. 686-724.
4. Lanier C. Benkard (2014) A Dynamic Analysis of the Market for Wide-bodied Commercial Aircraft. *Review of Economic Studies*, 81(2), p.p. 581-611.
5. Robert Sauer (2014) Educational Financing and Lifetime Earnings. *Review of Economic Studies*, 81(4), p.p. 1189-1216.
6. Guido Menzio, Nicholas Trachter (2015) Equilibrium Price Dispersion with Sequential Search. *Journal of Economic Theory*, 160(2), p.p. 188-215.
7. Timothy Taylor (2015) Recommendations for Further Reading. *Journal of Economic Perspectives*, 29(3), p.p. 209-216.
8. Davidson D., Frank Windmeijer (2015) More Reliable Inference for the Dissimilarity Index of Segregation. *The Journal of Econometrics*, 18 (1), p.p. 40-66.
9. Jinhyuk Lee, Kyoungwon Seo (2015) A Computationally Fast Estimator for Random Coefficients Logit Demand Models Using Aggregate Data. *Rand Journal of Economics*, 46(1), p.p. 86-102.
10. Michael S. Michael, Sajal Lahiri, Panos Hatzipanayotou (2015) Piecemeal Reform of Domestic Indirect Taxes Toward Uniformity in the Presence of Pollution: With and Without A Revenue Constraint. *Journal of Public Economics*, 17(2), p.p. 174-195.
11. Michael Vogt (2015) Testing for Structural Change in Time-Varying Nonparametric Regression Models. *Econometric Theory*, 31(4), p.p. 811-859.
12. Olivier Armantier, Eric Ghysels, Asani Sarkar (2015) Discount Window Stigma During the 2007-2008 Financial Crisis. *Journal of Financial Economics*, 118 (2), p.p. 317-335.

