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# Market transaction characteristics and pricing effect of accounting valuation models

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## Abstract

**Purpose** – In capital market, share prices of listed companies generally respond to accounting information. In 1995, Ohlson proposed a share valuation model based on two accounting indicators: company residual income and book value of net asset. In 2000, Zhang introduced the thought of option pricing and developed a new accounting valuation model. The purpose of this paper is to investigate the valuation deviation and the influence of some market transaction characteristics on pricing models.
**Design/methodology/approach** – The authors use listed companies from 1999 to 2013 as samples, and conduct comparative analysis with multiple regression.
**Findings** – The main findings are: first, the accounting valuation model is applicable to the capital market as a whole, and its pricing effect increases as years go by; second, in the environment of out capital market, the maturity of investors is one of important factors that causes the information content of residual income less than that of profit per share and lower pricing effect of valuation models; third, when the price earning (PE) of listed companies reaches certain level, the overall explanation capacity of accounting valuation models will become lower as PE gets higher; fourth, as for companies with higher turnover rate and more active transaction, the pricing effect of accounting valuation model is obviously lower; fifth, the pricing effect of accounting valuation models in a bull market is lower than in a bear market.
**Originality/value** – These findings establish connection between accounting valuation and market transaction characteristics providing an explorable orientation for the future development of accounting valuation theories and models.

**Keywords** Accounting valuation models, Residue profit, Shareholding ratio of institutional investors, Turnover rate
**Paper type** Research paper

## 1. Introduction

Although "value relevance" is one of important standards for measuring the quality of accounting information, the full use of accounting information by investors is regarded as a crucial aspect for improving effectiveness of capital market. However, one undeniable fact is that the pricing of share in capital market is not entirely decided by accounting information. There are already plenty of literatures with respect to study on the value relevance between accounting information and investors policy, among which the study of Ohlson (1995) can be rated as a classic in respect of accounting information valuation. He for the first time put forward to use residue profits and book value per share (BPS) as the valuation models of main factors. It can

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be said that Ohlson's work makes the study on value relevance no longer limited to empirical study of simple description of linear relevance phenomena, but more complete and solid interpretation in theory. Now the theoretical study with accounting information as share pricing basis has become an important branch in the study field of "value relevance" and some influential account valuation models have been developed successively (Zhang, 2000; Biddle *et al.*, 2001; Hao *et al.*, 2011a, b). Nevertheless, there remains a huge gap between accounting valuation results and market prices. Then, what makes such deviation, or what factors are influencing the pricing effect of accounting valuation models? So to speak, figuring out how deviation occurs and finding crucial factors on pricing effect is seeking a future direction for developing accounting valuation theory and improving accounting valuation models. Since Ohlson proposed the valuation model of residual income in 1995, many people have been studied on its applicability and pricing capacity and have developed some derivative models. For instance, Collins *et al.* (1997) found through research that the overall explanation capacity of models of Ohlson (1995) increased instead of declining as the time goes by during the 40 years from 1953 to 1993. Penman and Sougiannis (1998) compared the valuation deviation of cash flow model, accrual accounting model and dividend discounting model (DDM) derived from the model, and found that the deviation and error of accrual accounting model is relatively small and is obviously better than cash flow model and DDM. Frankel and Lee (1998) fitted fundamental value using unanimously expected profit information linear, and found the overall explanation capacity of fundamental value to cross-section difference of share transaction price can reach 70 percent or higher.

However, with the research advances, people found the overall explanation capacity of Ohlson (1995) may fluctuate under the influence of time series and cross-section factors under different situations. Some scholars hold the view that the limitation of pricing effect of Ohlson Model may be because the model neglected important variables in connection with the characteristics of the company. For example, Collins *et al.* (1997) believed that the change of the number of knowledge-intensive enterprises and small enterprises may result in fluctuation of explanation capacity of models as time goes by. Lev and Zarowin (1999) through studying relevance of intangible asset value found that accounting information of capital expenses such as R&D and advertisement expenses, etc. may also influence share price. Similar findings also included Zingales's (2000), Edmans's (2011),etc. study on employee's satisfaction and equity value. In order to improve the explanation capacity of models, Chen *et al.* (2002) carried out development on Ohlson (1995) Model, and added several variables that reflect the characteristics of the company, such as company size, leverage ratio and ratio of circulation stock.

The application studies of Ohlson Model facilitated development of accounting valuation theories. In 2000, Zhang combined the valuation functions of Ohlson (1995) and Feltham and Ohlson (1995, 1996) and dynamic capital investment option, and developed a new accounting information valuation theory and model (Zhang, 2000), which described the theoretical connections between accounting data, capital investment option and value generation process more intensely and carefully, and proposed valuation functions according to this and corresponding to different companies (companies with different profitability) and further discussed why the function of accounting data reflecting the dynamic process of future capital investment may be influenced by accounting stability. Zhang (2000) by loosening linear information hypothesis made capital pricing function more flexibly describe the

dynamic process of companies conducting value generation process with different capital asset options, and the mechanism of how such dynamic process determined future cash flow of the company, making the valuation theory better accord with facts, increasing the reasonableness and applicability of accounting valuation theories, and instilling new vigor into the field of accounting valuation.

Thereafter, some studies focussed on the non-linear component of mutual relation between accounting information and capital price, and expounded the necessity to improve the accounting information linear valuation model (such as Ohlson Model, Feltham-Ohlson Model, etc.), and further established new valuation models by introducing listed companies operational investment options and loosening the basic hypothesis that there is only linear relevance between pricing factors and capital prices. For example, Biddle *et al.* (2001) extended from the most basic hypothesis "profit seeking" in the field of real option, and associated with accounting information valuation study, and studied the dynamic process of profitability driving capital investment and influencing residual income in both theoretical and empirical aspects. Chen and Zhang (2007) extended the study of the relation between equity value and accounting measurements, and revealed how accounting indicators influence cross-section variation of stock yields in both theoretical and empirical aspects. Recently, some literatures further developed Zhang's (2000) theory, and studied on the applicability of valuation function proposed by him in actual capital market and its pricing effect as well as if the phenomena forecasted with the valuation theory actually exist. For instance, Hao *et al.* (2011a) by further studying the role of investment opportunities in potential growth capacity retested and examined the relevance between accounting number and value of equity, and tested the non-linear relation between the equity value and accounting data, and laid an emphasis on the influence of investment on such non-linear relation. While Hao *et al.* (2011b) focussed on the influence of profit-seeking capacity and potential growth rate on company valuation function. Chen *et al.* (2014) further extended the above-mentioned research and appointed out that industrial competition can force management better respond to good and bad prospect, and invest and withdraw investment in a timely manner, which would make the value of growth option and liquidation option gain more weight in the overall company value in the company value function.

However, all studies on relevant accounting valuation models mentioned above have one defect, namely, they have only paid attention to accounting information and the company itself but lack consideration of factors such as transaction behavior and transaction process, etc. in the capital market. Because in the view of finance, capital pricing depends on many factors, such as operation conditions of company fundamentals, market structure, transaction characteristics and investor sentiments, etc. The literatures of this aspect include Capital Asset Pricing Models (CAPM) theory and its development (Sharpe, 1964; Grossman *et al.*, 1987; Heaton, 1995), "FF three-factor model" and its development (Fama and French, 1992, 1993, 2012; Pontiff and Schall, 1998; Ali *et al.*, 2003), investor sentiments in capital pricing (Lakonishok *et al.*, 1992; Shleifer and Vishny, 1997; Baker and Wurgler, 2006). But it seems that these studies evolve in parallel with accounting valuation model study, and accounting valuation study uses the research results of asset pricing of finance in a limited way.

Therefore, this paper is to study pricing effect of accounting valuation model in two directions, i.e. length and cross-wise direction. First, from length wise direction, introducing Zhang (2000) model after studying Ohlson (1995) model, and observe if the explanation of the new model has improved compared with the classic model. Then

from the cross-wise direction, observe the influence of some factors of market transaction such as adequacy of market capital, transaction activity and ups and downs of market on old and new accounting valuation models, analyze the difference, degree and direction of such influence, and attempt to establish some connections between accounting valuation and market transaction characteristics.

The main findings are: first, the above-mentioned accounting valuation model is applicable in our capital market generally, and its pricing effect increases as years go by; second, in the environment of capital market of China, the difference of sophistication of investors is one of important factors that cause the information content of residual income less than that of profit per share and limit the pricing effect of Ohlson (1995) Model; third, when the price earning (PE) ratio of listed companies reach a certain level, the overall explanation capacity of accounting valuation models will become lower as PE ratio gets higher; fourth, as for companies with higher turnover rate and more active transaction, the pricing effect of accounting valuation model will decrease obviously; fifth, the pricing effect of accounting valuation models in a bull market is lower than in a bear market.

The major contributions of the paper: first, by comparing the pricing effect of Ohlson Model and Zhang Model, finding that different accounting indicators have different information content, or have different influence on pricing; second, the findings in the paper have certain contribution on improving accounting valuation models and development of accounting information relevance study, especially in the aspect of providing some new evidences and new points, namely, looking for the limitation of accounting valuation model effect from the view point of asset pricing lays a foundation on further study and development of accounting valuation theory in the environment of capital market.

The following work includes: literature review and development of hypothesis, sample and methodology, test of accounting valuation method in the capital market of China, influence of adequacy degree of market capital, transaction activity and market ups and downs on the pricing effect of accounting valuation model, and finally the conclusion.



## 2. Literature review and hypothesis development

### *2.1 Ohlson Model*

The theoretical starting point of the residual income model proposed by Ohlson (1995) is an authentication and extension on traditional accounting information valuation theory. Peasnell (1982) used to directly assume that company value is equal to the sum of the company's current net asset and current value of profit generated in each period in the future, while Ohlson Model (1995) divides dividend into current surplus and change of book value of net asset, thus deriving the valuation model with the residual income and BPS as main pricing factors. During the period from 1990 to 1996, Ohlson published a series of studies (Ohlson, 1990, 1995; Feltham and Ohlson, 1995, 1996), during which he developed the residual income pricing theory, making it a general model for studying accounting information pricing question and widely used for information pricing of company fundamentals.

Ohlson (1995) Model is based on three important hypotheses:

*H1.* The value of equityis decided by the current value of expected dividend. Namely, $P_t = \sum_{\tau+1}^{\infty} R_f^{-\tau} E[d_{t+\tau}]$, it means Ohlson (1995), the same as the DDM, uses the future net income from company's operation, i.e. mathematic expression of stock intrinsic value as the starting point of model derivation.

*H2.* The accounting indicators follow clean surplus relation, i.e. the change of net asset equals to earnings after dividend. Namely, after algebraic transformation, $bv_t = bv_{t-1} + x_t - d_t$, or $d_t = x_t - (bv_t - bv_{t-1})$ so that dividend becomes a linear combination of accounting indicators which will not be influenced by the dividend policy of the company. This is one of the important basics for accounting pricing.

*H3.* The time series of residual income follows the first-order linear auto correlation relation. The formula is:

$$x^{\alpha}_{t+1} = \omega x^{\alpha}_{t} + v_t + \varepsilon_{1,t+1}$$

$$v_{t+1} = \gamma v_t + \varepsilon_{2,t+1}$$

Based on such relation, the accounting information, as the reflection of business performance of the company of current period, can have a linear relevance relation with future income of the company, and can be used as a pricing tool.

With the above-mentioned three simultaneous hypothetical formulas, the theoretical model of Ohlson (1995) can be derived:

$$P_t = bv_t + \alpha_1 x^{\alpha}_{t} + \alpha_2 v_t$$

In other words, the asset price $P$ is quite close to the linear combination of the residue income and company net asset determined by clean surplus relation.

A lot of empirical research around the world use the base form of the empirical model corresponding to the Ohlson (1995) Model accordingly, and conducted extensive studies on and exploration to a series of relevant questions based on the model. The studies conducted by Bernard (1995), Penman and Sougiannis (1998) and Frankel and Lee (1998) show that the residual income model is much better than DDM and cash flow discounting model when explaining cross-section difference of share price, and its overall explanation capacity is also better than the latter, which embodies the improvement of the residual income theory compared to dividend discounting and cash flow discounting theory.

But people also found that Ohlson (1995) Model was unstable under different situations, and the overall explanation capacity fluctuated significantly and even lost validity due to time series and cross-section factors. For example, Dechow *et al.* (1999) found that the valuation of residual income model may underestimate share price to a certain degree; Callen and Morel (2001)'s study also found that Ohlson (1995) Model based on linear information hypothesis AR(1) and AR(2) process also may underestimate share price to a certain degree; Lee *et al.* even found that when using Ohlson (1995) Model for pricing in American and Korean market, the reaction co-efficient of book value became negative, which totally contradicted the theoretical prediction; Collins *et al.* (1997) studied the change of explanation capacity of Ohlson (1995) Model, and tried to explain the reasons for causing such fluctuation. The research results obtained by scholars such as Chen in our country also showed that compared with USA and other developed countries, Ohlson (1995) Model had lower explanation capacity in our country, with the average explanation capacity of samples from 1991 to 1998 being only 25 percent. In addition, the empirical results obtained by Wang *et al.* (2001) also verified the fact that the model had limited explanation capacity in the capital market environment of our country.

*2.2 Zhang Model*

Although compared with Ohlson Model, the theoretical model proposed by Zhang (2000) is relatively new, it is also an accounting valuation model. They have the same theoretical point: proceeding with the value created from business operation of the listed companies, and deriving the theoretical transaction price from the mathematical expression of the intrinsic value of securities.

Zhang (2000) Model starts from prescribing cash flow of asset stock of company generated from business operation, and assumes that at period $t$, the company would face three situations: first, the company runs in low efficiency, or even fail to survive, second, the company continues operation at a stable scale, third, the company is in an expansion stage. The value functions of the company vary under the three situations. According to Zhang's (2000) deduction, as the operating efficiency of the company varies, the value formula of the company can further be refined into discriminatory pricing models aimed at different companies. As for low-efficient companies, as it is less likely that their equity value will realize high growth in the future, and they are more likely to suffer operation failure, the call option value in value function is close to 0, while the put option value is relatively high, therefore the valuation model is:

$$V_t = \frac{x_t + \Delta u_t}{R-1} + P_{\mathrm{d}}\left(\frac{x_t + \Delta u_t}{B_{t-1} + u_{t-1}}\right)(B_t + u_t)$$

Similarly, for companies with high operation efficiency and increasing performance, their value is:

$$V_t = \frac{1}{R-1}(x_t + \Delta u_t) + C_e\left(\frac{x_t + \Delta u_t}{B_{t-1} + u_{t-1}}\right) \times G$$

While for companies with stable operation, as the operation of each period is quite stable, its value is close to a discounted value of stable future cash flows:

$$V_t = \frac{1}{R-1}(x_t + \Delta u_t)$$

Therefore, the basic characteristics of company value function can come down to: first, the value of a low efficient company is close to a linear combination of current surplus and BPS; second, the value of a company with stable operation is close to the discounted value of earnings of each period; third, the value of a growth company is decided by the current surplus and potential growth opportunities.

Based on the above-mentioned value functions of the three companies, we can develop the corresponding multiple regression valuation models.

*2.3 Discussion on accounting valuation models*

Though Ohlson, based on intrinsic value theories, proposed and analyzed why the intrinsic value should be equal to linear combination of residual income and BPS, in empirical study, the overall explanation capacity of Ohlson valuation model is relatively low. How to explain such phenomenon? We believe that if we observe from the global view of asset pricing study, it will not be difficult to find that as an accounting valuation model, and there are natural missing variables at the beginning, this may be the reason why the explanation capacity of the model is limited.

First, the model missed some information in respect of company asset characteristics that can influence the future operation results of the company. When Collins *et al.* (1997) tried to explain the change of the overall valuation efficiency of Ohlson Model during 40 years, they had considered if factors such as change of number of knowledge-intensive enterprises and small enterprises caused lower pricing efficiency of the model. Callen and Morel's (2001) study also proposed that the different value functions of different companies may also be one of the reasons that influence the share price fitting degree of Ohlson Model. In other words, it is very likely that the main pricing factors of differently companies are different, and it may be not applicable for some companies in the market to price with residual income and BPS. Furthermore, Lev and Zarowin (1999), Amir and Lev (1996), Lev and Sougiannis (1996) and Hirshleifer *et al.*'s (2013) study on intangible asset value relevance, especially study on capital expenses such as R&D, advertisement, etc., Kogan and Papanikolaou's (2014) study on proprietary technology and share performance, Zingales (2000), Edmans (2011) and Donangelo's (2014) study on characteristics of human resources as well as Hong and Kacperczyk's (2009) study on influence of operation of negative warfare industries on company value show that there are many asset characteristics related to company's equity value, so it is not able to cover all above information with only company residual income and BPS. These missed factors will influence the overall explanation capacity of Ohlson Model, and also lead to Ohlson Model's significant difference of pricing effect on different types of companies.

Second, as accounting valuation models are devoted to mathematical description of intrinsic value of company assets, while less emphasis is paid on market pricing and transaction characteristics of company equity, it is inevitable that the explanation capacity will be influenced. This is the great difference between the accounting valuation models and the asset pricing models, such as "CAPM" and "FF Three-factor Models." In 1964, Sharpe (1964) proposed the CAPM model, and regarded system risk as the sole as well as the most important factor for explaining the stock return highlighting the influence of asset price on capital market. After that, Grossman *et al.* (1987), Wheatley (1988), Hansen and Singleton (1983), Weil (1989), Constantinides and Duffie (1996), Heaton (1995), Lewellen and Nagel (2006), Jagannathan and Wang (2007), etc. focussed on CAPM and its derivative model, and studied the influence of rational decision making of investors on asset price. Amihud and Mendelson (1986), Brennan *et al.* (1998), Amihud (2002), Pastor and Stambaugh (2003) and Liu (2006) conducted a plenty of study on the relation between stock liquidity and asset prices. Zhu and Guo (1999), Wang *et al.* (2008), Yang *et al.*'s (2008) empirical study on the capital market of our country indicates that the proportion of outstanding shares may significantly influence share price. On the basis of CAPM, Fama and French (1992, 1993) proposed the famous "FF Three-factor Models," in which they added another two explaining variables: company size and book-to-market ratio. But it was found in the subsequent studies that there are still many unexplained parts in the three-factor model, such as short-term reversal, medium-term momentum, fluctuation, skewness and other factors (Scott and Horvath, 1980; Campbell and Hentschel, 1992; Jegadeesh and Titman, 1993; Lakonishok *et al.*, 1994; Brennan *et al.*, 1998; Fama and French, 2012). Obviously, compared with accounting valuation model and these models, many factors in respect of market transaction have not been considered.

Third, the above two types of study have the same precondition, namely, the market is effective. However, as behavioral financial theory sprang up and the hypothesis of effective market was unstick, investors's sentiment and mentality became a research

subject of scholars. For instance, Lakonishok *et al.* (1992), Song and Wu (2001), Wu and He (2005), Xu *et al.* (2013) studied the influence of investors' sentiment on asset price. Among them, Fisher and Statman (2000), Brown and Cliff (2004, 2005), Wang and Sun (2004), Chen's (2005) studies supported the conclusion that investors' sentiment had a significant influence on yield of stock market. While Zhang and Yang (2009) examined and verified investor's optimistic/pessimistic sentiment's asymmetric influence on stock yield and asset price rise/decline. Undoubtedly, the accounting valuation model represented by Ohlson Model is unable to effectively explain the influence of sentimental behaviors of traders on asset price. This is also one of the defects of most accounting valuation models.

### *2.4 Research questions*

Ohlson (1995) Model is a classic model of accounting valuation models. Although it has overall applicability in Chinese capital market, it has limited pricing ability (Chen *et al.*, 2002; Wang *et al.*, 2001), which may be influenced by many factors, especially factors that are related to market and transaction characteristics.

In order to find out the reason why pricing of the model become ineffective and improves accounting valuation models, this paper is to study in two directions, i.e. length and cross-wise direction. First, from length wise direction, following the evolvement of accounting valuation theory, introducing Zhang (2000) Model on the base of studying Ohlson (1995) Model, and observing if the explanation of the new model has improved compared with the classic model. Then from the cross-wise direction, observing the influence of some factors of market transaction such as adequacy of market capital, transaction activity and ups and downs of market on old and new accounting valuation models, analyzing the difference, degree and direction of such influence, so as to improve accounting valuation models in the future. The purpose of investigation is to actively explore to develop accounting valuation theories, in particular, establishing some connections between accounting valuation and market transaction characteristics.

The paper first examines the validity of accounting valuation models in the capital market of our country. Then, it studies the transition of the overall pricing effect of these models as time goes by, and gives a reasonable explanation. After that, it observes the influence of these market transaction characteristics on the pricing effect of these models. Use pricing effect to measure the overall explanation capacity of regression models. The higher explanation capacity indicates better pricing ability.

As for market transaction characteristics, first, we pay attention to the influence of PE ratio . A series of studies aiming at the PE ratio level of our capital market indicate that the PE in our capital market is significantly driven by capital flow, and has an obvious characteristic of "monetary market" and "capital market." Compared to foreign market, the closeness between PE ratio and fundamentals of listed companies is relatively lower, which is an outstanding character in our capital market (Dai, 2001; Chen, 2002; Lu and Chen, 2005). Therefore, although the market capital flow information contained in PE has an immediate influence on asset price, it cannot be reflected in accounting valuation model. While "FF Three-factor" model has considered such type of factor, and book-to-market ratio is just a similar factor. For this reason, we group the PE ratio from high to low, so as to observe the influence of PE ratio on pricing effect of valuation models, especially orientation formed due to deviation.

Apart from PE ratio, we also investigated the influence of transaction activity and ups and downs of market on pricing effect of accounting valuation models.

Transaction activity can be measured by turnover rate. The higher the turnover rate indicates more investors participating in transaction and better market mobility. We rank the samples in order of turnover rate, and observe the change of overall explanation capacity of valuation models. Similarly, the overall market ups and downs may also influence the pricing effectiveness of accounting valuation models. Chen (2004) also pointed out that when the market is up, the group psychology of investors and "Herding Effect" thus incurred are most obvious. Such effect is a classic irrational reaction of investors. If investors' irrational impulsion increases, the effectiveness of market price will be weakened. A large number of empirical studies have verified the asymmetric influence of the overall sentiment of capital market on fluctuation of asset price (Verma and Verma, 2007; He and Li, 2007; Zhang and Yang, 2009; Lu and Chen, 2012; Zhang and Wang, 2013; Wen *et al.*, 2014). Therefore, in this paper, I will observe the pricing effect of accounting valuation models in two environments of overall market ups and overall market downs.

## 3. Sample and methodology

### *3.1 Sample*

In this paper, We took samples from Wind database and Flush database which include all A share listed companies from 1999 to 2013, and the data include yearly reported and semi-yearly reported financial data and the transaction data of corresponding window period. Limited by each main variable data range in the database, this paper excludes companies that miss data of current period and 700 financial companies from the cross-section samples. As the accounting valuation model is the extension of dividend discounting and free cash flow discounting model, and one of the preconditions for its discounting of future income is sustainable operation of the company that can bring positive future cash flow, but the past study on earnings response coefficient shows that there is a significant difference between earnings response coefficient to negative and positive earnings, thus excluding 6,026 observation points of unprofitable enterprises and companies with negative net assets. In addition, considering the influence of seasoned equity offering on BPS as well as significant of difference of price fluctuation of newly listed companies and other companies, 3,171 observatory points of companies that have seasoned equity offering as announced that year and companies that has been listed less than a year are also excluded. After removing the extreme value of the double tail 1 percent, on the variables in the models, there are 25,370 observatory points on 28 cross-sections. There are 323 sample companies during annual report disclosure period of 1999 (from January of 2000 to April of 2000), which is the least. While there are 1,667 sample companies during annual report disclosure period of 2012 (from January of 2013 to April of 2013), which is the most.

### *3.2 Research model*

First, We show the empirical Ohlson (1995) Model. According to theory of Ohlson (1995) Model, asset price $P$ should be close to a linear combination of residual income and company BPS which is determined by clean surplus relations. This way we will obtain a multiple regression model composed of residual income (RI) and BPS, see Formula (1). Here we use the closing price ($P$) on (0, +2) days of announcement date of listed companies as a dependent variable, and residual income and BPS as a observed variable.

In addition, we choose a traditional EPS-BPS accounting information value relevance model as reference, see Formula (2), replacing RI with EPS:

$$P = \alpha_0 + \alpha_1 \mathrm{RI} + \alpha_2 \mathrm{BPS} + \varepsilon \quad (1)$$

$$P = \alpha_0 + \alpha_1 \mathrm{EPS} + \alpha_2 \mathrm{BPS} + \varepsilon \quad (2)$$

Fama and French (1992, 1993, 1996) and Chen *et al.*'s (2002) past series of study indicate that company size, leverage ratio and proportion of outstanding shares have a significant influence on stockprice. Therefore, in this paper, company size (SIZE), leverage ratio (LEV) and proportion of outstanding shares (LIQD) are added as control variables based on Ohlson (1995) Model, so as to observe the incremental information contained in control variables an the influence on observed variables, see following formula:

$$P = \alpha_0 + \alpha_1 \mathrm{RI} + \alpha_2 \mathrm{BPS} + \alpha_3 \mathrm{SIZE} + \alpha_4 \mathrm{LEV} + \alpha_5 \mathrm{LIQD} + \varepsilon \quad (3)$$

Referring to Chen *et al.*'s (2002) study, calculating residual income in the aforesaid model according to formula:

$$\mathrm{RI}_t = [\mathrm{NI}_t - \mathrm{NA}_{t-1} \times (\beta - 1)]/\mathrm{TSHARE}_t \quad (4)$$

Where counting the net profit of current period announced by the company, is net asset of the previous period, and the number of circulation stock of current period, the calculation adopts window phase of (−255, −6) days of announcement data based on return rates of individual share and market index (Shanghai Composite Index, Shenzhen Composite Index and Growth Enterprise Index).

In order to find out the reason of low explanation capacity of Ohlson Model, we introduced a new model in the accounting valuation theory – Zhang (2000) Model. In the aforementioned theoretically analysis part, we summarize the basic characteristics of company value function as: first, the value of a low efficient company is close to a linear combination of current earnings and book value; second, the value of a company with stable operation is close to the discounted value offuture earnings; third, the value of a growth company is decided by the current earnings and potential growth opportunities. That is to say, the value function of any type of company can be seen as being composed of three parts of pricing information: surplus information of current profitability (EPS), information of book value (BPS) and information related to potential growth rate in the future (Growth). In this way, we can construct a multiple regression model, see following formula:

$$P_t = \alpha_0 + \alpha_1 \mathrm{EPS}_t + \alpha_2 \mathrm{BPS}_t + \alpha_3 \mathrm{GROWTH}_{t+1} + \varepsilon_t \quad (5)$$

Similarly, on this basis, after considering control variables such as SIZE, LEV and LIQD, thus following formula can be obtained:

$$P_t = \alpha_0 + \alpha_1 \mathrm{EPS}_t + \alpha_2 \mathrm{BPS}_t + \alpha_3 \mathrm{GROWTH}_{t+1} + \alpha_4 \mathrm{SIZE}_t + \alpha_5 \mathrm{LEV}_t + \alpha_6 \mathrm{LIQD}_t + \varepsilon_t \quad (6)$$

Table I shows the definition of relevant variables in this paper.

| Symbols of variables | Names of variables | Definitions of variables |
|---|---|---|
| *P* | Share price | The closing price on the second transaction day after disclosure |
| RI | Residual income | Residue income per share calculated by clean surplus relation |
| EPS | Earnings per share | Currnet earnings per share in the announcement |
| BPS | Book value per share | Net asset per share announced of the current period |
| GROWTH | Equity value growth rate | Equity value growth rate of listed companies of one year after announcement |
| SIZE | Company size | Log value of announced equity of current period of listed companies |
| LEV | Leverage ratio | Asset-liability ratio of current period of listed companies |
| LIQD | Proportion of outstanding shares | Proportion of outstanding shares of current period of listed companies |
| PE | Price to earnings ratio | Dynamic PE ratio on the second transaction day after disclosure |
| TURNOVER | Turnover rate | Quarterly turnover rate of the stock |
| ASCEND | Ascend interval | Dummy variable, in rising interval ASCEND = 1, while in a decline interval ASCEND = 0 |

**Table I.**
Definition of variables



*3.3 Descriptive statistics and relevance analysis of variables*

Table II shows the descriptive statistical results of variables. The table shows that the average value of EPS profit is 0.228, and average residual income is 0.106, indicating nearly half of earnings per share are cost of capital required by the shareholders, and the other half is residual income. The table also shows that the standard deviation of EPS is 0.233, and the standard deviation of RI is 1.268, much greater than the former, indicating the difference of residual income per share of different companies is much greater than that of earnings per share.

Table III shows the PEARSON and SPEARMAN relevance analysis of each variable. The numbers in the left-lower corner are PEARSON analysis results, and numbers in the right-upper corner are SPEARMAN analysis results. The table shows that the observed and control variables are correlated significantly to share price (*P*), and there is a positive correlation between RI, EPS, BPS and GROWTH and *P*. In addition, the negative correlation between LEV and $\beta$ and *P*, indicating the influence of

| Variable | Obs. | Mean | SD | Min. | Max. |
|---|---|---|---|---|---|
| *P* | 25,370 | 11.22 | 7.341 | 1.950 | 70.76 |
| RI | 25,370 | 0.105 | 1.627 | −7.689 | 13.23 |
| EPS | 25,370 | 0.228 | 0.233 | 0.00180 | 2.107 |
| BPS | 25,370 | 3.410 | 1.720 | 0.338 | 13.21 |
| GROWTH | 25,370 | 0.092 | 0.306 | −3.404 | 16.50 |
| SIZE | 25,370 | 9.334 | 0.448 | 8.323 | 11.20 |
| LEV | 25,370 | 45.16 | 18.73 | 2.774 | 89.86 |
| LIQD | 25,370 | 60.05 | 26.00 | 13.19 | 100 |
| PE | 25,370 | 90.19 | 153.8 | −11.85 | 2,627 |
| TURNOVER | 25,370 | 0.198 | 0.241 | 9.30e-05 | 18.67 |

**Table II.**
Descriptive statistics of variables

**Table III.**
Relevant analysis of each variable

| | *P* | RI | EPS | BPS | GROWTH | SIZE | LEV | LIQD | PE | TURNOVER |
|---|---|---|---|---|---|---|---|---|---|---|
| *P* | 1 | 0.252 | 0.52 | 0.382 | 0.265 | −0.08 | −0.203 | −0.0416 | 0.0592 | −0.469 |
| | | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| RI | 0.288 | 1 | 0.313 | 0.0285 | 0.193 | 0.0069 | −0.0394 | −0.0621 | −0.158 | −0.249 |
| | 0.000*** | | 0.000*** | 0.000*** | 0.000*** | 0.272 | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| EPS | 0.555 | 0.318 | 1 | 0.525 | 0.374 | 0.251 | −0.12 | −0.0285 | −0.716 | −0.327 |
| | 0.000*** | 0.000*** | | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| BPS | 0.419 | 0.0905 | 0.538 | 1 | 0.0571 | 0.298 | −0.254 | 0.0008 | −0.375 | −0.256 |
| | 0.000*** | 0.000*** | 0.000*** | | 0.000*** | 0.000*** | 0.000*** | 0.901 | 0.000*** | 0.000*** |
| GROWTH | 0.144 | 0.0678 | 0.112 | −0.0029 | 1 | 0.108 | 0.0729 | 0.0267 | −0.285 | −0.107 |
| | 0.000*** | 0.000*** | 0.000*** | 0.639 | | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| SIZE | −0.0303 | 0.0062 | 0.278 | 0.268 | 0.0344 | 1 | 0.398 | 0.288 | −0.382 | −0.0294 |
| | 0.000*** | 0.326 | 0.000*** | 0.000*** | 0.000*** | | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| LEV | −0.181 | −0.0583 | −0.0873 | −0.271 | 0.0524 | 0.395 | 1 | 0.172 | −0.0053 | 0.135 |
| | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | | 0.000*** | 0.395 | 0.000*** |
| LIQD | −0.0278 | −0.0963 | 0.0254 | −0.0049 | 0.0283 | 0.298 | 0.174 | 1 | −0.0243 | 0.19 |
| | 0.000*** | 0.000*** | 0.000*** | 0.434 | 0.000*** | 0.000*** | 0.000*** | | 0.000*** | 0.000*** |
| PE | −0.0177 | −0.0862 | −0.328 | −0.218 | −0.0884 | −0.192 | 0.0353 | 0.0038 | 1 | 0.0558 |
| | 0.005*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.549 | | 0.000*** |
| TURNOVER | −0.287 | −0.144 | −0.216 | −0.198 | −0.0455 | −0.0671 | 0.0843 | 0.0581 | 0.0506 | 1 |
| | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | 0.000*** | |

**Notes:** *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

asset risks on price. SIZE and LIQD are negatively correlated to *P*. Table III also shows that correlation coefficient of SIZE, EPS and BPS are quite big, indicating that if the size is big, the amount of the BPS is generally big and the announced earnings per share is also big. The correlation coefficient of residual income and SIZE, LEV, LIQD are all small.

## 4. Test of accounting valuation models

### *4.1 The pricing effect of accounting valuation models*

In Table IV, we test the applicability of three accounting valuation models during 1999 to 2003 in the stock market of our country. Table IV includes single-factor regression model of RI, EPS and BPS as well as Ohlson Model as stated in Formula (3) and Zhang Model as stated in Formula (6), and has compared traditional EPS-BPS valuation models.

Table IV shows that in the three single-variable models, RI, EPS and BPS are significant at 1 percent level, indicting a relatively high correlation with share price. The results accord with the research results of residual income valuation model of Chen *et al.* (2001) and Wang *et al.* (2001). The explanation capacity of traditional EPS-BPS model, Ohlson Model and Zhang Model are 32.8, 23.9 and 33.7 percent, respectively, indicating that the three models are all effective, and traditional EPS-BPS model and Zhang Model have better explanatory effect than Ohlson Model. After adding control variables, Ohlson Model (Formula (3)) and Zhang Model (Formula (6)) also obtain similar results. This shows that: first, the information content of BPS is higher than residual income; second, the overall explanation capacity of Ohlson (1995) Model and Zhang (2000) Model are 23.9 and 33.7 percent, respectively, higher than that of two groups of single-factor tests. Obviously, the two valuation models are both applicable to our capital market.

Comparing Ohlson Model with traditional EPS-BPS model and Zhang Model, we can see that the pricing effect of Ohlson Model is significantly lower. Considering the fact that the explanation capacity difference between Zhang Model and traditional EPS-BPS model is quite small, and that the newly added information content of potential growth capacity index (GROWTH) is very little, we believe that the pricing effect difference between Zhang Model and Ohlson Model is not because the Ohlson Model fails to reflect potential growth capacity (GROWTH) of company equity value, but because the value correlation of residual income and information content is significantly lower than EPS. First, as single-factor test result shows, the information content of single-factor of EPS reaches 30.8 percent, while the information content of single-factor of RI is only 8.3 percent, with the reaction coefficient significantly lower than EPS.

Then, comparing newly-added information content of the two, the newly-added information content of EPS is 15.2 percent, significantly higher than that of RI of 6.3 percent. Due to difference of value relevance of EPS and newly-added information content, the joint explanation capacity of overall EPS and BPS to Price of traditional EPS-BPS model reaches 32.8 percent, significantly higher than the explanation capacity of 23.9 percent of Ohlson (1995) Model. This conclusion conforms to the conclusion reached by Chen *et al.* (2002). Generally speaking, the above results indicates that in the background of capital market in our country, the accounting information included in Ohlson (1995) Model has significant pricing effect, but in information relevant to company income, the pricing effect of residual information is significantly lower than income information per share.

**Table IV.**
Analysis on pricing effect of accounting valuation models

| | Predicted symbols | Single factor (1) | Single factor (2) | Single factor (3) | Ohlson Model Formula (2) | Ohlson Model Formula (3) | EPS-BPS Model | Zhang Model Formula (5) | Zhang Model Formula (6) |
|---|---|---|---|---|---|---|---|---|---|
| RI | + | 1.299 (47.87)*** | | | 1.137 (45.80)*** | 1.145 (46.61)*** | | | |
| EPS | + | | | 17.503 (106.26)*** | | | 14.621 (75.98)*** | 14.148 (73.33)*** | 15.515 (82.35)*** |
| BPS | + | | 1.789 (73.54)*** | | 1.691 (72.06)*** | 1.903 (71.71)*** | 0.725 (27.86)*** | 0.761 (29.33)*** | 0.946 (34.77)*** |
| GROWTH | + | | | | | | | 2.257 (18.26)*** | 2.315 (19.42)*** |
| SIZE | +/− | | | | | −2.801 (−25.44)*** | | | −3.953 (−38.92)*** |
| LEV | − | | | | | 0.005 (2.08)** | | | 0.003 (1.17) |
| LIQD | + | | | | | 0.013 (8.30)*** | | | 0.008 (5.53)*** |
| _cons | | 11.087 (250.65)*** | 5.125 (55.17)*** | 7.226 (134.52)*** | 5.337 (59.70)*** | 29.717 (32.17)*** | 5.411 (64.47)*** | 5.190 (61.59)*** | 40.529 (47.44)*** |
| Adj. $R^2$ | | 0.083 | 0.176 | 0.308 | 0.239 | 0.261 | 0.328 | 0.337 | 0.385 |
| $F$ | | 2,291.527 | 5,408.203 | 11,290.219 | 3,976.458 | 1,795.477 | 6205.689 | 4,302.532 | 2,647.361 |
| $n$ | | 25,370 | 25,370 | 25,370 | 25,370 | 25,370 | 25,370 | 25,370 | 25,370 |

**Notes:** $t$-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

*4.2 Change over time of the model pricing effect*

In this part, we performed regression to traditional EPS-BPS model, Ohlson Model and Zhang Model, respectively, on a yearly basis, and found the curve of model explanation capacity change shown in Figure 1.

Figure 1 shows that change of the overall explanation capacity of the three accounting valuation models over time is generally the same with a gradually rising long-term trend, and the period with lowest explanation capacity concentrates on early years. Besides, we also notice that, apart from several periods from 2003 to 2004, in most cases, though the volatility of Ohlson Model and traditional EPS-BPS model and Zhang Model is quite the consistent, but it is obvious that the model built based on EPS has higher explanation capacity. It can visually seen from Figure 1 that the overall explanation capacity of traditional EPS-BPS model and Zhang Model is very close, and in most periods exceeds Ohlson Model. This indicates that over decades the interpretation of and response to pricing information contained in accounting indicators of investors in capital markets are quite stable, and information content and value relevance of EPS is higher than residual income.

According to Ohlson's theoretical deduction, the explanation capacity to company value of linear combination of residual income and book value should be no lower than the linear combination of earnings and book value. But the observed phenomena indicate that the pricing effect of EPS is significantly better than RI. Chen *et al.*'s (2002) explanation for this is that RI as residual income has lower continuity than EPS. While we believe that this may indirectly reflect the "limited rationality" of investors.

The limited rationality of investors is related to its limited pricing information processing capacity, and this is also the reason why the above-mentioned two types of different pricing information are accepted by users to different degrees. EPS is the most intuitive and the most important information in the financial report of listed companies. As it is based on the situation that accounting principles and different companies have the same EPS calculating aperture, it has strong comparability and it is more convenient in pricing application. However, RI, as a linear combination of earnings per share and BPS, is not directly disclosed in company announcement, and needs

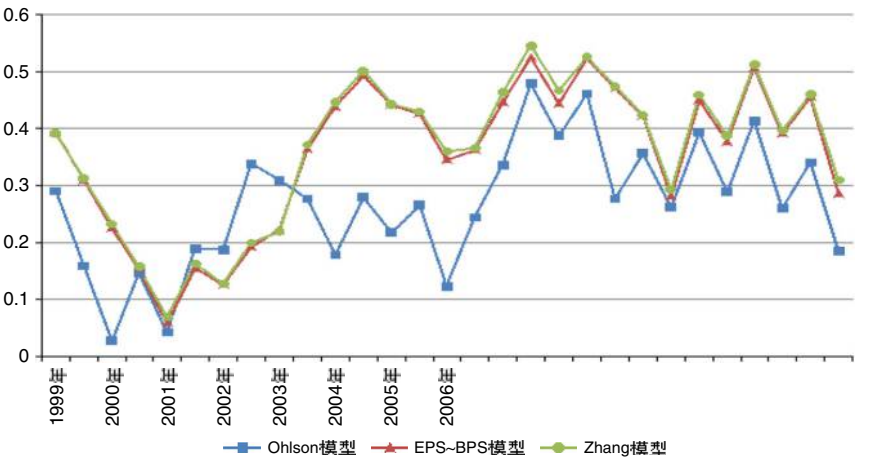



**Figure 1.**
Change of explanation capacity of Ohlson Model, Zhang Model and traditional EPS-BPS model

**Note:** The vertical axis represents the overall explanation capacity of the model

estimation of capital cost during calculation, while the calculation results of capital costs may vary greatly with different time windows and different index return, resulting in inconsistent calculating aperture of RI and lower comparability of RI among companies. Therefore, the value relevance of EPS in pricing is higher than RI.

*4.3 Explanation from the point of investors' information processing ability*

From the preceding results, we know that the difference of explanation capacity of the three valuation models centers on the value relevance of EPS and RI. In our opinion, the difference of the information processing ability of investors may be one of the reasons. To test the deduction, we will investigate the influence of shareholding ratio of institutional investors on value relevance of accounting indicators in the future. Because generally speaking, institutional investors are more mature than individual investors, and their information processing ability is also better than that of individual investors.

There are only data on institutional investors' shareholding from 2003 to 2013 in database. we will equally divide all sample companies according to announced shareholding ratio of institutional investors of current period, setting a virtual variable INS. INS = 1 means the subsample with relatively high shareholding ratio, and INS = 0 means the subsample with relatively low shareholding ratio. Interaction terms of INS and EPS, RI, BPS,namely EPS × INS, RI × INS and BPS × INS are also added on the basis of the three accounting valuation models so as to test the influence of shareholding ratio of institutional investors on the response coefficient of each accounting indicator. See the regression results in Table V.

Table V shows that whether adding variables SIZE, LEV and LIQD or not, institutional shareholding ratio has a significant influence on value relevance of EPS, RI and BPS. The significant positive cross-term indicates that institutional investors indeed have relatively high interpretation degree and more quick response to the above-mentioned information. Dividing the shareholding ratio of institutional investors into low and high subsamples, their reaction coefficient of EPS are 12.30 and 14.11, respectively, and the difference is 1.81. This indicates that there is a slight change between the reaction degree of the two subsamples; while the reaction coefficients of RI are 0.67 and 1.44, respectively, indicating that when RI fluctuates, the adjustment range of asset price of the latter is more than twice as much as that of the former, namely, the subsample with higher shareholding ratio of institutional investors is more reactive. The results better support out conclusion: different interpretation ability of investors to accounting information is an importance reason that causes different pricing effect of EPS and RI.

## 5. Influence of adequacy of market capital on pricing effect of accounting valuation models

From the above discussion we can see that all the three accounting valuation models are effective in capital market of China, but none of them has an explanation capacity over 50 percent. Although institutional investors may improve the pricing capacity of accounting valuation models, the increasing of explanation capacity is very limited. This indicates that there are many non-accounting factors in respect of share pricing.

The aforementioned literature review has well expounded this, i.e. we need to refer to theories in respect of asset pricing in finance, to study the influence of stock market transaction characteristics on accounting valuation models, so as to improve

**Table V.**
Influence of Shareholding ratio of institutional investors on accounting pricing

| | Ohlson Model | | Traditional EPS-BPS Model | | Zhang Model | |
|---|---|---|---|---|---|---|
| RI | 0.667 (18.38)*** | 0.674 (18.94)*** | | | | |
| RI_INS | 0.776 (14.94)*** | 0.688 (13.32)*** | | | | |
| EPS | | | 12.300 (32.54)*** | 13.325 (36.66)*** | 11.949 (31.65)*** | 12.990 (35.82)*** |
| EPS_INS | | | 1.814 (4.05)*** | 1.824 (4.24)*** | 1.703 (3.81)*** | 1.690 (3.94)*** |
| BPS | 1.249 (43.71)*** | 1.302 (40.99)*** | 0.601 (17.62)*** | 0.597 (16.85)*** | 0.658 (19.37)*** | 0.646 (18.36)*** |
| BPS_INS | 0.756 (34.01)*** | 0.966 (38.16)*** | 0.414 (11.90)*** | 0.668 (18.82)*** | 0.377 (10.90)*** | 0.631 (17.89)*** |
| GROWTH | | | | | 1.529 (7.30)*** | 1.461 (7.27)*** |
| GROWTH_INS | | | | | 1.367 (5.23)*** | 1.479 (5.89)*** |
| SIZE | | −3.021 (−26.53)*** | | −4.038 (−37.84)*** | | −4.005 (−37.88)*** |
| LEV | | 0.005 (1.86)* | | 0.003 (1.11) | | 0.001 (0.35) |
| LIQD | | −0.003 (−1.79)* | | −0.005 (−2.99)*** | | −0.005 (−3.02)*** |
| _cons | 5.020 (53.59)*** | 32.726 (33.57)*** | 4.960 (55.84)*** | 42.270 (46.33)*** | 4.700 (52.69)*** | 41.814 (46.23)*** |
| Adj. $R^2$ | 0.307 | 0.334 | 0.375 | 0.425 | 0.385 | 0.435 |
| $F$ | 2,483.367 | 1,606.797 | 3,365.956 | 2,369.122 | 2,345.417 | 1,923.761 |
| $n$ | 22,442 | 22,442 | 22,442 | 22,442 | 22,442 | 22,442 |

**Notes:** $t$-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

the pricing ability of accounting valuation model. For this purpose, first, we observe the influence of adequacy of market capital on pricing effect of accounting valuation models.

PE is a commonly used index in relative valuation method, involving the earnings per share of object companies and earnings per share and stock price of reference companies. A series of literatures point out that in the context of capital market, fluctuation of PE is usually driven by capital flow in market, and when the market fluidity is adequate and there is adequate capital, the PE of the overall market will increase. Otherwise, the PE will fall. In order to observe how the adequacy of capital influences the pricing effect of accounting valuation models, we divide all the samples into seven groups according to the value of PE of the current period announced by listed companies, and perform Ohlson Model, traditional EPS-BPS model and Zhang Model regression to the seven groups, respectively. The results can be seen in Table VI.

From Panel A of Table VI we can tell that there is an obvious inverted U relation between the explanation capacity of Ohlson Model and valuation multiples of listed companies PE, so is the reaction coefficient of RI and BPS. That is to say, in the groups with the highest PE and lowest PE, the value relevance of RI and BPS are lower than that of the neighboring groups. While in the group with the highest PE, the overall pricing effect obviously decreases as PE increases. In Panel B and Panel C, the regression results of traditional EPS~BPS model and Zhang Model are basically the same as Panel A. Obviously, the companies with higher PE have lower explanation capacity.

See the curve of change of explanation capacity of the three models in Figure 2, in which an inverted U curve is shown more clearly. Our explanation to this is that in the valuation the group with higher PE, the pricing difference brought by accounting information is covered by massive fund flow because of adequate capital. Like water in the lake, the deeper the water, the harder the landform under the water can influence the water flow. While in the valuation the group with lower PE, the situation is different. Due to serious lack of capital, the pricing capacity of accounting information may also be distorted, just as when drought occurs, the landform becomes visible, the landform will inevitably influence the water flow.

We noticed that both Table VI and Figure 2 show that in the group with lowest PE, the explanation capacity of the three models is relatively low. Our explanation is that it may be because that the companies with low PE value are far from market hot spots, and their transaction is more inactive than shares of other companies. The more inactive the transaction is, the harder the relevant information of operation of the companies will be diffused quickly through signals of transaction price, leading to the failure of information value to be fully explored, which further results in low fitting degree of transaction price and accounting information. While in the group with the highest PE, the explanation degree is far less than other groups. This indicates that for those companies closer to market hotpots, the disjunction between transaction price and business performance – accounting information is serious. Generally speaking, the more active the market is, more likely it is that plenty of irrational transaction will occur, thus resulting in low relevance between performance information and truncation price.

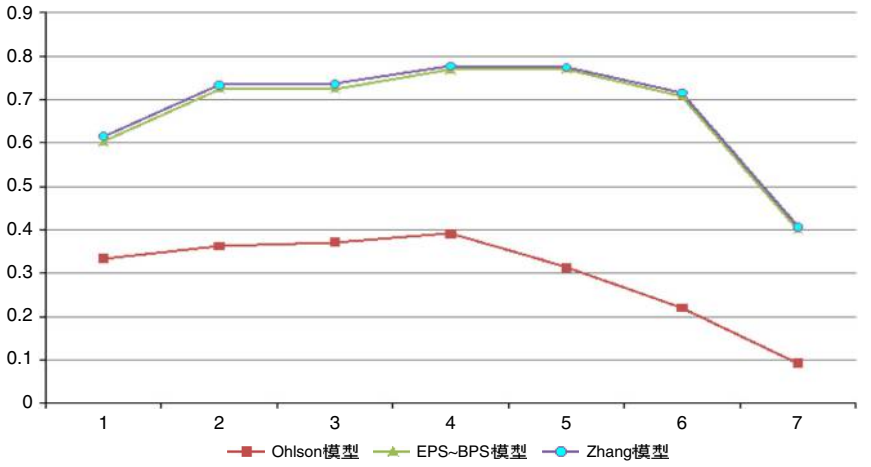
## 6. Influence of transaction active level on pricing effect of accounting valuation models

In order to study transaction characteristics of stock market on accounting valuation models, and to improve the pricing ability of accounting valuation models, in this part, we mainly investigate the influence of transaction active level on pricing effect of

**Table VI.**
Regression results of accounting valuation models ranked according to PE

| PE rank | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total samples |
|---|---|---|---|---|---|---|---|---|
| *Panel A – (Ohlson Model)* | | | | | | | | |
| RI | 0.452 (11.08)*** | 1.010 (20.97)*** | 1.328 (23.89)*** | 1.704 (25.32)*** | 1.602 (21.33)*** | 1.610 (20.27)*** | 1.047 (13.39)*** | 1.137 (45.87)*** |
| BPS | 1.607 (41.69)*** | 1.871 (38.46)*** | 1.981 (35.16)*** | 2.493 (37.95)*** | 2.460 (32.99)*** | 2.056 (25.48)*** | 1.253 (15.71)*** | 1.691 (72.09)*** |
| _cons | 2.084 (11.82)*** | 3.060 (14.47)*** | 4.173 (18.06)*** | 3.678 (14.69)*** | 4.727 (17.48)*** | 5.861 (23.06)*** | 7.308 (33.76)*** | 5.340 (59.80)*** |
| Adj. $R^2$ | 0.334 | 0.362 | 0.371 | 0.391 | 0.313 | 0.22 | 0.093 | 0.239 |
| *F* | 912.542 | 1,033.323 | 1,072.753 | 1,164.593 | 826.569 | 513.735 | 187.958 | 3,982.958 |
| *n* | 3,632 | 3,632 | 3,631 | 3,632 | 3,631 | 3,632 | 3,632 | 25,422 |
| *Panel B – (Traditional EPS-BPS Model)* | | | | | | | | |
| EPS | 11.052 (51.63)*** | 19.875 (75.99)*** | 26.704 (77.15)*** | 36.169 (87.52)*** | 49.294 (92.87)*** | 73.734 (84.52)*** | 116.737 (46.13)*** | 14.596 (75.89)*** |
| BPS | 0.632 (18.04)*** | 0.573 (15.59)*** | 0.628 (14.93)*** | 0.703 (15.25)*** | 0.666 (13.99)*** | 0.503 (9.58)*** | 0.585 (8.97)*** | 0.727 (27.95)*** |
| _cons | 1.516 (11.15)*** | 1.811 (12.92)*** | 1.842 (11.94)*** | 1.793 (11.60)*** | 1.974 (12.51)*** | 2.879 (18.06)*** | 4.934 26.83)*** | 5.413 (64.54)*** |
| Adj. $R^2$ | 0.603 | 0.724 | 0.724 | 0.769 | 0.771 | 0.708 | 0.4 | 0.328 |
| *F* | 2,761.011 | 4,766.946 | 4,772.422 | 6,060.725 | 6,110.44 | 4,394.318 | 1,212.492 | 6,200.296 |
| *n* | 3,632 | 3,632 | 3,631 | 3,632 | 3,631 | 3,632 | 3,632 | 25,422 |
| *Panel C – (Zhang Model)* | | | | | | | | |
| EPS | 10.800 (50.84)*** | 19.366 (74.14)*** | 25.942 (75.58)*** | 35.208 (85.13)*** | 48.785 (91.91)*** | 72.383 (83.51)*** | 115.376 (45.83)*** | 10.800 (50.84)*** |
| BPS | 0.666 (19.20)*** | 0.636 (17.40)*** | 0.698 (16.84)*** | 0.779 (17.01)*** | 0.710 (14.94)*** | 0.541 (10.40)*** | 0.584 (9.00)*** | 0.666 (19.20)*** |
| GROWTH | 2.939 (10.56)*** | 3.153 (11.61)*** | 3.902 (13.17)*** | 3.573 (12.15)*** | 1.594 (7.97)*** | 2.228 (9.90)*** | 0.861 (5.57)*** | 2.939 (10.56)*** |
| _cons | 1.123 (8.06)*** | 1.374 (9.60)*** | 1.370 (8.85)*** | 1.376 (8.83)*** | 1.765 (11.14)*** | 2.739 (17.31)*** | 4.933 (27.02)*** | 1.123 (8.06)*** |
| Adj. $R^2$ | 0.615 | 0.734 | 0.737 | 0.778 | 0.775 | 0.716 | 0.407 | 0.615 |
| *F* | 1,930.938 | 3,326.306 | 3,390.458 | 4,243.275 | 4,155.345 | 3,047.212 | 829.363 | 1,930.938 |
| *n* | 3,625 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,625 | 3,625 |

**Notes:** *t*-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$




**Note:** The vertical axis represents the overall explanation capacity of the model

**Figure 2.** Change of explanation capacity of Ohlson model, Zhang model and traditional EPS-BPS model that have been performed regression according to PE grouping

accounting valuation models. Market active level is used to measure turnover rate. We will divide samples into seven groups according to turnover rate and perform regression, respectively. The results are shown in Table VII and Figure 3.

Table VII shows that in Panel A the explanation capacity of Ohlson Model with the lowest turnover rate is 26.1 percent, ranking the highest. As the turnover rate increases, the overall explanation capacity of the models decreases, presenting a stair type. In the two groups with the highest turnover rates, namely, group 6 and group 7, the explanation capacity of models declines to around 10 percent, which is obviously lower than that of other groups. In addition, both the reaction coefficients of RI and BPS significantly decrease as the turnover rate increases. The reaction coefficient of RI decreases from 1.314 to 0.217, and the reaction coefficient also decrease from 2.108 to 0.958. That is to say, the increasing of turnover rate will significantly decrease the pricing effect of Ohlson Model, and even render it ineffective.

Considering the relatively low relevance coefficients between turnover rate and other independent variables, all of which are less than 0.22, in particular, the absolute value of relevant coefficients of the company size (SIZE), leverage rate (LEV) and proportion of outstanding shares (LIQD) are less than 0.1, we assume that the influence of turnover rate on explanation capacity of Ohlson Models and reaction coefficients of RI and BPS cannot be used to explain other independent variables and co-linearity of turnover rates.

Similar to Ohlson Model, the overall explanation capacity of Zhang (2000) model decreases monotonically and strictly as the turnover rate increases. In respect of the reaction coefficients of pricing factors, the reaction coefficients of EPS and GROWTH significantly decrease as the turnover rate increases, except that the reaction coefficient of BPS is quite stable, presenting strict and monotonic decrease. In Panel B in Table VII, the grouping regression results of traditional EPS-BPS models shows the same conclusion.

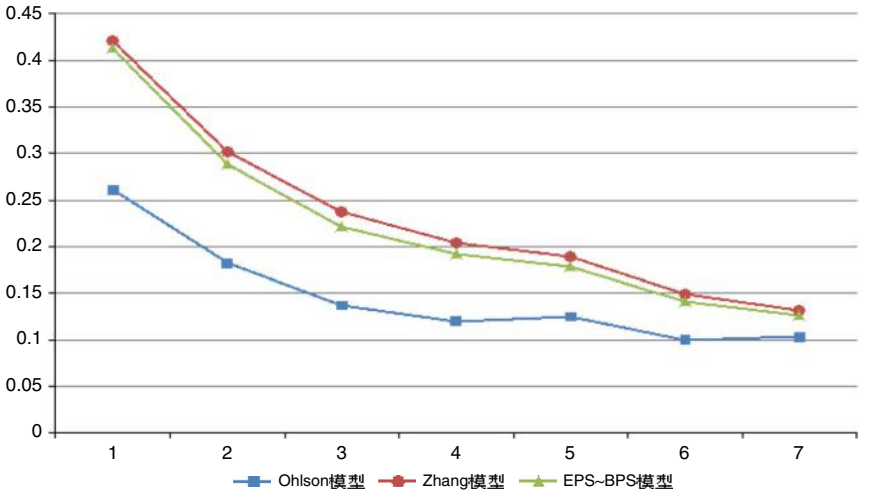
As for pricing effect of the three accounting valuation models with the change of turnover rate, Figure 3 shows a very intuitional comparison.

In order to observe the influence of turnover rate further, we only divide samples into two groups with Ohlson Model as a representative. The dummy variable High = 1 indicates the group with high turnover rate, and High = 0 indicates the group with

**Table VII.**
Regression results of accounting valuation models when grouping according to turnover rates

| Turnover rank | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total samples |
|---|---|---|---|---|---|---|---|---|
| *Panel A-Ohlson Model* | | | | | | | | |
| RI | 1.314 (17.63)*** | 0.689 (10.32)*** | 0.539 (9.10)*** | 0.379 (6.67)*** | 0.371 (6.89)*** | 0.384 (7.06)*** | 0.217 (4.55)*** | 1.137 (45.80)*** |
| BPS | 2.108 (26.33)*** | 1.564 (25.08)*** | 1.174 (22.27)*** | 1.070 (21.26)*** | 1.060 (22.34)*** | 0.979 (19.53)*** | 0.958 (20.47)*** | 1.691 (72.06)*** |
| _cons | 8.154 (24.39)*** | 7.779 (28.71)*** | 7.258 (32.47)*** | 6.754 (34.65)*** | 5.988 (35.09)*** | 5.483 (33.66)*** | 4.485 (34.74)*** | 5.337 (59.70)*** |
| Adj. $R^2$ | 0.261 | 0.182 | 0.137 | 0.12 | 0.125 | 0.1 | 0.103 | 0.239 |
| *F* | 639.595 | 404.611 | 288.139 | 247.266 | 259.685 | 201.286 | 209.877 | 3,976.458 |
| *n* | 3,625 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,625 | 25,370 |
| *Panel B-Traditional EPS-BPS Model* | | | | | | | | |
| EPS | 19.411 (36.45)*** | 12.649 (25.69)*** | 9.670 (22.03)*** | 8.675 (19.32)*** | 7.468 (17.01)*** | 7.033 (15.08)*** | 4.951 (10.70)*** | 14.621 (75.98)*** |
| BPS | 0.606 (7.08)*** | 0.663 (9.57)*** | 0.549 (9.56)*** | 0.587 (10.81)*** | 0.677 (13.52)*** | 0.591 (11.03)*** | 0.718 (14.60)*** | 0.725 (27.86)*** |
| _cons | 9.080 (30.39)*** | 7.644 (30.23)*** | 7.015 (33.00)*** | 6.414 (34.20)*** | 5.743 (34.58)*** | 5.454 (34.28)*** | 4.466 (35.05)*** | 5.411 (64.47)*** |
| Adj. $R^2$ | 0.413 | 0.288 | 0.221 | 0.192 | 0.179 | 0.141 | 0.126 | 0.328 |
| *F* | 1,273.700 | 733.521 | 516.194 | 431.867 | 396.219 | 298.552 | 261.901 | 6,205.689 |
| *n* | 3,625 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,625 | 25,370 |
| *Panel C-Zhang Model* | | | | | | | | |
| EPS | 18.696 (34.73)*** | 12.140 (24.73)*** | 9.316 (21.36)*** | 8.357 (18.66)*** | 7.019 (15.90)*** | 6.690 (14.29)*** | 4.578 (9.81)*** | 14.148 (73.33)*** |
| BPS | 0.672 (7.86)*** | 0.716 (10.41)*** | 0.584 (10.24)*** | 0.610 (11.30)*** | 0.703 (14.08)*** | 0.614 (11.47)*** | 0.728 (14.86)*** | 0.761 (29.33)*** |
| GROWTH | 3.004 (7.15)*** | 2.841 (8.69)*** | 2.225 (8.82)*** | 2.028 (7.27)*** | 1.956 (6.77)*** | 1.279 (5.79)*** | 1.021 (5.19)*** | 2.257 (18.26)*** |
| _cons | 8.721 (28.98)*** | 7.288 (28.74)*** | 6.764 (31.86)*** | 6.220 (33.07)*** | 5.579 (33.44)*** | 5.326 (33.30)*** | 4.415 (34.67)*** | 5.190 (61.59)*** |
| Adj. $R^2$ | 0.421 | 0.302 | 0.238 | 0.204 | 0.189 | 0.149 | 0.132 | 0.337 |
| *F* | 877.919 | 524.221 | 377.327 | 309.653 | 282.716 | 211.976 | 184.811 | 4,302.532 |
| *n* | 3,625 | 3,624 | 3,624 | 3,624 | 3,624 | 3,624 | 3,625 | 25,370 |

**Notes:** *t*-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$




**Note:** The vertical axis represents the overall explanation capacity of the model

**Figure 3.** Regression results of Ohlson Model, Zhang Model and traditional EPS-BPS model when grouping according to turnover rates

relatively low turnover rate. Then add interaction terms on this basis, and observe the difference of reaction significance of RI and BPS in statistical sense, and control SIZE, LEV and LIQD at the same time. See the regression results in Table VIII. Table VIII shows that the results of the first line and second line are the same as those in Table VII, indicating that when the turnover rate is high, the overall explanation capacity of Ohlson Model is low, and the reaction coefficients of RI and BPS are also relatively low. The third and fourth line in Table VIII show that whether adding control variables, the coefficients of RI × HIGH and BPS × HIGH are significantly negative. This is to say, when the turnover rate is relatively high, the reaction coefficient of them will significantly decrease. To conclude, the regression results indicate that for stocks with high turnover rate, their pricing effect of Ohlson Model is lower.

Analysis to other two models also reaches the same conclusion.

| | High = 0 | High = 1 | Ohlson Model after adding interaction terms | Ohlson Model after adding interaction terms and control variables |
|---|---|---|---|---|
| RI | 1.115 (30.37)*** | 0.403 (14.06)*** | 1.117 (37.87)*** | 1.130 (38.82)*** |
| BPS | 1.593 (44.21)*** | 1.147 (45.03)*** | 1.827 (79.92)*** | 2.059 (80.05)*** |
| RI × High | | | −0.714 (−13.61)*** | −0.710 (−13.75)*** |
| BPS × High | | | −1.012 (−45.93)*** | −1.036 (−47.68)*** |
| SIZE | | | | −2.936 (−27.89)*** |
| LEV | | | | 0.008 (3.25)*** |
| LIQD | | | | 0.021 (13.55)*** |
| _cons | 7.431 (48.87)*** | 5.093 (60.22)*** | 6.317 (71.48)*** | 31.349 (35.46)*** |
| Adj. $R^2$ | 0.202 | 0.143 | 0.3 | 0.325 |
| $F$ | 1,611.054 | 1,062.771 | 2,725.244 | 1,747.479 |
| $n$ | 12,685 | 12,685 | 25,370 | 25,370 |

**Notes:** $t$-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

**Table VIII.** Regression results of Ohlson Model when grouping according to turnover rates

## 7. Influence of market ups and downs on pricing effect of accounting valuation models

As the investors' reaction to information cannot be completely rational, the performance of capital market fluctuation of our country in bull market and bear make shows obvious asymmetry (Gu and Jin, 2013; Wen *et al.*, 2014). In this part, we will compare samples in periods of market ups and downs, attempting to discuss the influence of irrational transaction on pricing effect of accounting valuation models by discriminating market in different trends.

The disclosure frequency of accounting data are relatively low, which is once a quarter, and market ups and down change very quickly, which may be several times of change in one quarter. In order to better observe the influence of market ups and downs on pricing effect of accounting valuation models, we choose the most representative rising sector and declining sector since the foundation of our capital market as observation periods, namely, using the data of the period from the first quarter of 2006 to the third quarter of 2007 as rising period, and the period from the fourth quarter of 2007 to the fourth quarter of 2008 as declining period. The regression results in Table IX show that Panel A is Ohlson Model, and Panel B is Zhang Model.

Table IX Panel A shows that in rising sector of market the explanation capacity of Ohlson Model is 23.9 percent, and newly added information content of RI and BPS are 10.9 and 9.5 percent, respectively, while in declining sector of market the explanation capacity is 27 percent, and newly added information content of RI and BPS are 7.8 and 12.5 percent, respectively. Compared with declining sector, the explanation capacity of Ohlson Model in rising sector is relatively low, in the mean while, the newly added information content of RI is relatively high, and the newly added information content of BPS is relatively low.

Panel B shows that in rising sector of market, the explanation capacity of Ohlson Model is 24.8 percent, and newly added information content of RI, BPS and GROWTH are 10.7, 1.9 and 0.7 percent, respectively, while in declining sector of market the explanation capacity is 33 percent, relatively high, and newly added information content of RI, BPS and GROWTH are 11.4, 6.3 and 2.6 percent, respectively. Compared with declining sector, the overall pricing efficiency of Zhang (2000) Model in rising sector is relatively low, and the newly added information content of the pricing factors is relatively low.

In order to verify the influence of market ups and downs on the reaction coefficients of each accounting indicator, we use dummy variable ASCEND to represent market ups and downs. When the market is in rising sector of market, ASCEND = 1, otherwise ASCEND = 0. Cross-terms RI × ASCEND and BPS × ASCEND in Ohlson Model and Zhang Model, size (SIZE) are added, and LEV and proportion of outstanding shares (LIQD) are controlled. See Table X for regression results.

Obviously, whether adding controlling variables or not, when the market goes up, the reaction coefficient RI of Ohlson Model increases significantly, and reaction coefficient of BPS reduces significantly. By combining the results in Table IX we can conclude: when the market is in obviously rising sector, the explanation capacity of Ohlson Model is relatively low, the newly added information content of RI is relatively high, and the newly added information content and reaction coefficient of BPS is relatively low, while when the market is in an obviously declining sector, the results are on the contrary. Zhang Model also reaches the similar conclusion. When the market goes up, the reaction coefficient rises significantly, and the reaction coefficient of BPS reduces significantly, which can be proved by the relevant

**Table IX.** Comparison of regression results of Ohlson Model and Zhang Model in Rising sector and declining sector of market

*Panel A-Ohlson Model*

| | Rising sector | | | Declining sector | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | |
| RI | 2.793 (31.73)*** | | 3.172 (34.32)*** | 2.546 (25.33)*** | | 3.357 (31.88)*** | |
| BPS | 2.115 (29.67)*** | 2.443 (32.39)*** | | 2.453 (32.03)*** | 2.941 (37.72)*** | | |
| _cons | 3.522 (16.13)*** | 2.966 (12.75)*** | 9.449 (101.28)*** | 3.272 (12.74)*** | 2.863 (10.61)*** | 10.545 (81.12)*** | |
| Adj. $R^2$ | 0.239 | 0.13 | 0.144 | 0.27 | 0.192 | 0.145 | |
| *F* | 1,103.19 | 1,049.213 | 1,178.003 | 1,108.394 | 1,422.708 | 1,016.469 | |
| *n* | 7,009 | 7,009 | 7,009 | 5,975 | 5,975 | 5,975 | |

*Panel B-Zhang Model*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| EPS | 14.562 (28.83)*** | | 17.435 (38.32)*** | 15.447 (31.28)*** | 12.642 (31.89)*** | | 16.647 (44.39)*** | 12.495 (30.94)*** |
| BPS | 1.068 (12.42)*** | 2.203 (26.95)*** | | 1.026 (11.90)*** | 1.861 (23.70)*** | 2.929 (38.11)*** | | 1.887 (23.58)*** |
| GROWTH | 1.112 (7.57)*** | 2.092 (13.69)*** | 0.996 (6.71)*** | | 2.603 (15.26)*** | 2.471 (13.39)*** | 2.690 (15.08)*** | |
| _cons | 3.634 (15.20)*** | 2.304 (9.19)*** | 6.256 (55.10)*** | 3.834 (16.06)*** | 3.397 (13.71)*** | 2.585 (9.69)*** | 8.385 (61.27)*** | 3.680 (14.61)*** |
| Adj. $R^2$ | 0.248 | 0.141 | 0.229 | 0.241 | 0.33 | 0.216 | 0.267 | 0.304 |
| *F* | 639.755 | 476.001 | 859.845 | 922.001 | 980.524 | 822.244 | 1,087.739 | 1,303.777 |
| *n* | 5,800 | 5,800 | 5,800 | 5,800 | 5,975 | 5,975 | 5,975 | 5,975 |

**Notes:** *t*-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

| | Panel A-Ohlson Model | | | Panel B-Zhang Model | |
|---|---|---|---|---|---|
| | Adding interaction terms | Adding interaction terms and control variables | | Adding interaction terms | Adding interaction terms and control variables |
| | | | EPS | 12.660 (34.47)*** | 12.706 (34.61)*** |
| RI | 2.549 (27.67)*** | 2.561 (26.14)*** | BPS | 1.833 (30.37)*** | 2.124 (32.21)*** |
| BPS | 2.420 (43.99)*** | 2.479 (38.89)*** | GROWTH | 2.598 (16.42)*** | 2.523 (16.06)*** |
| RI × ASCEND | 0.240 (1.81)* | 0.226 (1.68)* | EPS_ASCEND | 1.848 (2.82)*** | 2.389 (3.67)*** |
| BPS × ASCEND | −0.268 (−5.84)*** | −0.271 (−5.85)*** | BPS_ASCEND | −0.723 (−12.22)*** | −0.797 (−13.52)*** |
| | | | GROWTH_ASCEND | −1.477 (−6.57)*** | −1.428 (−6.41)*** |
| SIZE | | 0.02 (0.11) | SIZE | | −2.186 (−11.34)*** |
| LEV | | 0.027 (6.53)*** | LEV | | 0.006 (1.52) |
| LIQD | | −0.011 (−2.34)** | LIQD | | −0.037 (−8.33)*** |
| _cons | 3.395 (20.27)*** | 2.203 (1.30) | _cons | 3.501 (20.26)*** | 23.718 (14.14)*** |
| Adj. $R^2$ | 0.266 | 0.269 | Adj. $R^2$ | 0.318 | 0.329 |
| $F$ | 1,179.599 | 683.078 | $F$ | 915.463 | 641.988 |
| $n$ | 12,984 | 12,984 | $n$ | 11,775 | 11,775 |

**Notes:** $t$-statistics in parentheses. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

**Table X.**
Regression results of Ohlson Model and Zhang Model in Ups and Downs

regression results of Ohlson Model. It is noteworthy that the reaction coefficient of GROWTH in Zhang Model is also significantly low. This indicates that investors' identification to future growth rate is reduced when the market goes up, representing more obvious irrationality.

To sum up, when the capital market is in a rising sector, the pricing effect of accounting valuation models lowers, which may indirectly reflect the influence of irrational market transaction behavior on pricing effect of accounting valuation models.

## 8. Conclusion

Ohlson (1995) proposed a valuation model with residual income and BPS as main factors, which reflects value relevance of accounting information. Zhang (2000) proposed a new accounting valuation model based on option pricing. However, there is still a huge difference between accounting valuation results and market prices. In order to improve accounting valuation theories and develop accounting valuation models, to understand how market transaction characteristics influence the pricing effect of these models, we conducted analysis on data of listed companies from 1999 to 2013, the main conclusion of which includes:

(1) Ohlson Model and Zhang Model are applicable in our capital market as a whole, and their pricing effectiveness increases over time. Since 2007, the explanation capacity of Ohlson Model is between 20 and 40 percent, significantly higher than early years. But compared with capital market of developed countries such as USA and France, the explanation capacity is relatively low and obviously lower than traditional EPS-BPS model and Zhang Model.

(2) In the capital market of our country, the explanation capacity of traditional EPS-BPS model and Zhang Model is very close, and the added information content of potential growth ability is relatively low, while the pricing effect of Ohlson Model is obviously lower than traditional EPS-BPS model, and Zhang Model. The main reason for such difference is the relevant difference of residual

income and earnings per share. In addition, high shareholding of institutional investors is beneficial for improving the reaction coefficient of various accounting indicators, and the improvement level of reaction coefficient of residual income is greater than earnings per share, indicating that the overall maturity of investors in capital market is quite limited. Individual investors interpret and pay attention to information not directly disclosed in financial report in a limited way, which is one of the important reasons why the information content of accounting indicators in our capital market is quite low and the pricing effect of accounting valuation model is not high.

(3) The pricing effect of accounting valuation model is obviously influenced by PE. When the PE of listed companies reaches a certain level, the overall explanation capacity of Ohlson Model will decrease as PE increases. Zhang Model also has similar performance. That is to say, the explanation capacity of accounting valuation model of companies with high PE is relatively low.

(4) As for companies with relatively high turnover rate and active transaction, the pricing effect of Ohlson Model and Zhang Model are both significantly low. While the trend that the explanation capacity of Zhang Model decreases as turnover rate increases is strictly monotonic. Such phenomenon is embodied by relatively low reaction coefficient of residual income, earnings per share and BPS as well as relatively low overall explanation capacity of two accounting valuation models.

(5) The pricing effect of accounting valuation models is different in rising market and declining market. When the market is in an obviously rising sector, the explanation capacity of accounting valuation model is relatively low, newly added information content and reaction coefficient of residual income and earnings per share are relatively high, and newly added information content and reaction coefficient of BPS is relatively low. While when the market is in an obviously declining market, the results are the opposite.

The above findings have established some connections between accounting valuation and market transaction characteristics. If taking in these connections in accounting valuation, and taking the deviation resulted from market transaction into consideration, the pricing effect of accounting valuation models may be improved. Accordingly, in our opinion, these findings are meaningful to the development of accounting valuation theory in the future, or at least providing an explorable direction.

## References

Ali, A., Hwang, L. and Trombley, M.A. (2003), "Arbitrage risk and the book-to-market anomaly", *Journal of Financial Economics*, Vol. 69 No. 2, pp. 355-373.

Amihud, Y. (2002), "Illiquidity and stock returns: cross-section and time-series effects", *Journal of Financial Markets*, Vol. 5 No. 1, pp. 31-56.

Amihud, Y. and Mendelson, H. (1986), "Asset pricing and the bid-ask spread", *Journal of Financial Economics*, Vol. 17 No. 2, pp. 223-249.

Amir, E. and Lev, B. (1996), "Value- relevance of non-financial information: the wireless communications industry", *Journal of Accounting and Economics*, Vol. 22 Nos 1-3, pp. 3-30.

Baker, M. and Wurgler, J. (2006), "Investor sentiment and the cross-section of stock returns", *Journal of Finance*, Vol. 61 No. 4, pp. 1645-1680.

Bernard, V.L. (1995), "The Feltham-Ohlson framework: implications for empiricists", *Contemporary Accounting Research*, Vol. 11 No. 2, pp. 733-747.

Biddle, G., Chen, P. and Zhang, G. (2001), "When capital follows profitability: nonlinear residual income dynamics", *Review of Accounting Studies*, Vol. 6 Nos 2-3, pp. 229-265.

Brennan, M.J., Chordia, T. and Subrahmanyam, A. (1998), "Alternative factor specifications, security characteristics, and the cross-section of expected stock returns", *Journal of Financial Economics*, Vol. 49 No. 3, pp. 345-373.

Brown, G.W. and Cliff, M.T. (2004), "Investor sentiment and the near-term stock market", *Journal of Empirical Finance*, Vol. 11 No. 1, pp. 1-27.

Brown, G.W. and Cliff, M.T. (2005), "Investor sentiment and asset valuation", *Journal of Business*, Vol. 78 No. 2, pp. 405-439.

Callen, J.L. and Morel, M. (2001), "Linear accounting valuation when abnormal earnings are AR(2)", *Review of Quantitative Finance and Accounting*, Vol. 16 No. 3, pp. 191-203.

Campbell, J.Y. and Hentschel, L. (1992), "No news is good news: an asymmetric model of changing volatility in stock returns", *Journal of Financial Economics*, Vol. 31 No. 3, pp. 281-318.

Chen, C.J.P., Chen, S. and Su, X. (2001), "Is accounting information value-relevant in the emerging Chinese stock market?", *Journal of International Accounting, Auditing and Taxation*, Vol. 10 No. 1, pp. 1-22.

Chen, H. (2004), "Empirical study on herd behavior of institutional investors in stock market of China", *Nankai Economic Studies*, No. 2, pp. 91-94 (in Chinese).

Chen, P. and Zhang, G. (2007), "How do accounting variables explain stock price movements? Theory and evidence", *Journal of Accounting and Economics*, Vol. 43 Nos 2-3, pp. 219-244.

Chen, X., Chen, D. and Zhu, H. (2002), "Net asset, residual income and market pricing: value relevance of accounting information", *Journal of Financial Research*, No. 4, pp. 59-70 (in Chinese).

Chen, X., JinQinglu, Xiao, T. and Zhang, G. (2014), "Industry competition, managerial investment and equity value of growth/put options".

Chen, Y. (2005), "Mood swing and asset price fluctuation", *Economic Research Journal*, No. 3, pp. 36-45 (in Chinese).

Chen, Z. (2002), "Bubbles of a share in stock market of Shanghai: measurement and comprehensive interpretation of PE", *The Journal of World Economy*, No. 7, pp. 63-70 (in Chinese).

Collins, D.W., Maydew, E.L. and Weiss, I.S. (1997), "Changes in the value-relevance of earnings and book values over the past forty years", *Journal of Accounting and Economics*, Vol. 24 No. 1, pp. 39-67.

Constantinides, G. and Duffie, D. (1996), "Asset pricing with heterogeneous consumers", *Journal of Finance*, Vol. 104 No. 2, pp. 219-240.

Dai, Y. (2001), "Formation mechanism of bubbles in stock market and further consideration trigger by great debate-review on distort of stock market and complex of stock dominated by institutional investor", *Economic Research Journal*, No. 4, pp. 41-50 (in Chinese).

Dechow, P.M., Hutton, A.P. and Sloan, R.G. (1999), "An empirical assessment of the residual income valuation model", *Journal of Accounting and Economics*, Vol. 26 Nos 1-3, pp. 1-34.

Donangelo, A. (2014), "Labor mobility: implications for asset pricing", *Social Science Electronic Publishing*, Vol. 69 No. 3, pp. 1321-1346.

Edmans, A. (2011), "Does the stock market fully value intangibles? Employee satisfaction and equity prices", *Journal of Financial Economics*, Vol. 101 No. 3, pp. 621-640.

Fama, E.F. and French, K.R. (1992), "The cross-section of expected stock returns", *Journal of Finance*, Vol. 47 No. 2, pp. 427-465.

Fama, E.F. and French, K.R. (1993), "Common risk factors in the returns on stocks and bonds", *Journal of Financial Economics*, Vol. 33 No. 93, pp. 3-56.

Fama, E.F. and French, K.R. (1996), "Multifactor explanations of asset pricing anomalies", *Journal of Finance*, Vol. 51 No. 1, pp. 55-84.

Fama, E.F. and French, K.R. (2012), "Size, value and momentum in international stock returns", *Journal of Financial Economics*, Vol. 105 No. 3, pp. 457-472.

Feltham, G. and Ohlson, J. (1995), "Valuation and clean surplus accounting for operating and financial activities", *Contemporary Accounting Research*, Vol. 11, pp. 689-731.

Feltham, G. and Ohlson, J. (1996), "Uncertainty resolution and the theory of depreciation measurement", *Journal of Accounting Research*, Vol. 34 No. 2, pp. 209-234.

Fisher, K.L. and Statman, M. (2000), "Investor sentiment and stock returns", *Financial Analysts Journal*, Vol. 56 No. 2, pp. 16-23.

Frankel, R. and Lee, C.M.C. (1998), "Accounting valuation, market expectation, and cross-sectional stock returns", *Journal of Accounting and Economics*, Vol. 25 No. 3, pp. 283-319.

Grossman, S.J., Melino, A. and Shiller, R. (1987), "Estimating the continuous-time consumption-based asset-pricing model", *Journal of Business & Economic Statistics*, Vol. 5 No. 3, pp. 315-327.

Gu, F. and Jin, D. (2013), "Overreaction of investors and asymmetry of fluctuation of bull and bear market", *Journal of Applied Statistics and Management*, Vol. 32 No. 3, pp. 533-544 (in Chinese).

Hansen, L.P. and Singleton, K.J. (1983), "Stochastic consumption, risk aversion, and the temporal behavior of asset returns", *Journal of Political Economy*, Vol. 91 No. 2, pp. 249-265.

Hao, S., Jin, Q. and Zhang, G. (2011a), "Investment growth and the relation between equity value, earnings, and equity book value", *The Accounting Review*, Vol. 86 No. 2, pp. 605-635.

Hao, S., Jin, Q. and Zhang, G. (2011b), "Relative firm profitability and stock return sensitivity to industry-level news", *The Accounting Review*, Vol. 86 No. 4, pp. 1321-1347.

He, X. and Li, T. (2007), "Asymmetric reaction of stock market under different market situations-based on empirical analysis on Shanghai stock market of China", *Journal of Financial Research*, No. 8, pp. 131-140 (in Chinese).

Heaton, J. (1995), "An empirical investigation of asset pricing with temporally dependent preference specifications", *Econometrica*, Vol. 63 No. 3, pp. 681-717.

Hirshleifer, D., Hsu, P. and Li, D. (2013), "Innovative efficiency and stock returns", *Journal of Financial Economics*, Vol. 107 No. 3, pp. 632-654.

Hong, H. and Kacperczyk, M. (2009), "The price of sin: the effects of social norms on markets", *Journal of Financial Economics*, Vol. 93 No. 1, pp. 15-36.

Jagannathan, A.R. and Wang, Y. (2007), "Lazy investors, discretionary consumption, and the cross-section of stock returns", *Journal of Finance*, Vol. 62 No. 4, pp. 1623-1661.

Jegadeesh, N. and Titman, S. (1993), "Returns to buying winners and selling losers: implications for stock market efficiency", *Journal of Finance*, Vol. 48 No. 48, pp. 65-91.

Kogan, L. and Papanikolaou, D. (2014), "Growth opportunities, technology shocks, and asset prices", *Journal of Finance*, Vol. 69 No. 2, pp. 675-718.

Lakonishok, J., Shleifer, A. and Vishny, R.W. (1992), "The impact of institutional trading on stock prices", *Journal of Financial Economics*, Vol. 32 No. 1, pp. 23-43.

Lakonishok, J., Shleifer, A. and Vishny, R.W. (1994), "Contrarian investment, extrapolation, and risk", *Journal of Finance*, Vol. 49 No. 5, pp. 1541-1578.

Lev, B. and Sougiannis, T. (1996), "The capitalization, amortization and value relevance of R&D", *Journal of Accounting Economics*, Vol. 21 No. 1, pp. 107-138.

Lev, B. and Zarowin, P. (1999), "The boundaries of financial reporting and how to extend them", *Journal of Accounting Research*, Vol. 37 No. 2, pp. 353-385.

Lewellen, J. and Nagel, S. (2006), "The conditional CAPM does not explain asset-pricing anomalies", *Journal of Financial Economics*, Vol. 82 No. 2, pp. 289-314.

Liu, W. (2006), "A liquidity-augmented capital asset pricing model", *Journal of Financial Economics*, Vol. 82 No. 3, pp. 631-671.

Lu, G. and Chen, X. (2005), "The pricing meaning of 'Zhuang' and accounting surplus", *Management World*, No. 7, pp. 48-54 (in Chinese).

Lu, J. and Chen, J. (2012), "Study on influence of investors' sentiment on cross-section income of stock", *Forecast*, Vol. 31 No. 5, pp. 52-57 (in Chinese).

Ohlson, J.A. (1990), "A synthesis of security valuation theory and the role of dividends, cash flows, and earnings", *Contemporary Accounting Research*, Vol. 6 No. 2, pp. 648-676.

Ohlson, J.A. (1995), "Earnings, book values, and dividends in security valuation", *Contemporary Accounting Research*, Vol. 11 No. 2, pp. 661-687.

Pastor, L. and Stambaugh, R.F. (2003), "Liquidity risk and expected stock returns", *Journal of Political Economy*, Vol. 111 No. 3, pp. 642-685.

Peasnell, K.V. (1982), "Some formal connections between economic values and yields and accounting numbers", *Journal of Business Finance and Accounting*, Vol. 9 No. 3, pp. 361-381.

Penman, S.H. and Sougiannis, T. (1998), "A comparison of dividend, cash flow, and earnings approaches to equity valuation", *Contemporary Accounting Research*, Vol. 15 No. 3, pp. 343-383.

Pontiff, J. and Schall, L.D. (1998), "Book-to-market ratios as predictors of market returns", *Journal of Financial Economics*, Vol. 49 No. 2, pp. 141-160.

Scott, R.C. and Horvath, P.A. (1980), "On the direction of preference for moments of higher order than the variance", *Journal of Finance*, Vol. 35 No. 4, pp. 915-919.

Sharpe, W.F. (1964), "Capital asset prices: a theory of market equilibrium under conditions of risk", *Journal of Finance*, Vol. 19 No. 3, pp. 425-442.

Shleifer, A. and Vishny, R.W. (1997), "The limits of arbitrage", *Journal of Finance*, Vol. 52 No. 1, pp. 35-55.

Song, J. and Wu, C. (2001), "Study on herd behavior in financial market based on dispersity", *Economic Research Journal*, No. 11, pp. 21-27 (in Chinese).

Verma, R. and Verma, P. (2007), "Noise trading and stock market volatility", *Journal of Multinational Management*, Vol. 17 No. 3, pp. 231-243.

Wang, J. and Sun, J. (2004), "Earnings, earnings fluctuation and investors' sentiment in Chinese market", *Economic Research Journal*, No. 10, pp. 75-83 (in Chinese).

Wang, M., Yang, C. and Liao, S. (2008), "Value research on liquidity of Chinese stock market – based on evidence of negotiating transfer of non-tradable share and transfer of restricted stock", *Journal of Finance and Economics*, No. 3, pp. 81-94 (in Chinese).

Wang, Y., Sunzheng and Chen, S. (2001), "Accounting reform and quality of accounting information- empirical evidences from securities market of China", *Accounting Research*, No. 7, pp. 16-26 (in Chinese).

Weil, P. (1989), "The equity premium puzzle and the risk-free rate puzzle", *Journal of Monetary Economics*, Vol. 24 No. 3, pp. 401-421.

Wen, F., Xiao, J. and Huang, C. (2014), "Study on influence of characteristics of investors' sentiment on pricing behavior of stocks", *Journal of Management Sciences in China*, Vol. 17 No. 3, pp. 60-69 (in Chinese).

Wheatley, S. (1988), "Some tests of the consumption-based asset pricing model", *Journal of Monetary Economics*, Vol. 22 No. 2, pp. 193-215.

Wu, X. and He, P. (2005), "Analysis on herd behavior of open-end funds in China", *Journal of Financial Research*, No. 5, pp. 60-69 (in Chinese).

Xu, N., Yu, S. and Yi, Z. (2013), "Herd behavior of institutional investors and risk of collapse of share price", *Management World*, No. 7, pp. 31-43 (in Chinese).

Yang, D., Wei, Y. and Ye, J. (2008), "Influence of equity division on empirical study on Chinese capital market and adjustment of model", *Economic Research Journal*, No. 3, pp. 73-86 (in Chinese).

Zhang, G. (2000), "Accounting information, capital investment decisions, and equity valuation: theory and empirical implications", *Journal of Accounting Research*, Vol. 38 No. 1, pp. 271-295.

Zhang, Q. and Yang, S. (2009), "Noise trading, fluctuation of investors' sentiment and stock earnings", *Systems Engineering-theory & Practice*, Vol. 29 No. 3, pp. 40-47 (in Chinese).

Zhang, Z. and Wang, H. (2013), "Investors' sentiment, adjustment of subjective belief and market fluctuation", *Journal of Financial Research*, No. 4, pp. 142-155 (in Chinese).

Zhu, W. and Guo, Z. (1999), "Reaction of price of stock market on the proportion of non-circulation shares: review on impact effect of release of non-circulation shares and strategies", *Economic Research Journal*, No. 5, pp. 32-38 (in Chinese).

Zingales, L. (2000), "In search of new foundations", *Journal of Finance*, Vol. 55 No. 4, pp. 1623-1653.

## Further reading

Daniel, K. and Titman, S. (1997), "Evidence on the characteristics of cross sectional variation in stock returns", *Journal of Finance*, Vol. 52 No. 1, pp. 1-33.

Chen, G. and Ran, L. (2011), "If PE can be an effective indicator for analysis of investment decision-from empirical data of a shares of China", *Accounting Research*, No. 9, pp. 9-16 (in Chinese).

Lee, G., Lee, D., Park, Y.S., Seo, J and Kim, E. (2000), "Application to residual income valuation model (the Korean experience)", working paper, Sogang University, Seoul, Korea.

Qinglu, J., Shuang, X. and Chunsheng, G. (2010), "Will process of marketization influence company's growth and liquidation value?", *Economists(quarterly)*, No. 4, pp. 1485-1504 (in Chinese).

Yang, Y. and Wan, D. (2010), "Alienation phenomenon of investors' sentiment, stock earnings and income fluctuation under different market status-based on empirical analysis of Shanghai stock market", *Systems Engineering*, No. 28, pp. 19-23 (in Chinese).

Yu, J., Yuan, Y. and Stambaugh, R.F. (2012), "The short of it: investor sentiment and anomalies", *Journal of Financial Economics*, Vol. 104 No. 2, pp. 288-302.

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