The roles of accounting data in equity valuation: evidence from China

Tiandong Wang and Tianxi Zhang
Antai College of Economics and Management, Shanghai Jiao Tong University, Shanghai, China

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Abstract

Purpose – The purpose of this paper is to examine the roles of earnings and book value (BV) in equity valuation.

Design/methodology/approach – The authors apply model's explanatory power to analyze the roles of accounting data and test the hypotheses empirically with a sample of Chinese listed companies between 2004 and 2010.

Findings – The authors find that impact of accounting data on equity value is also dependent on profitability, but the behavior is non-monotonic. In the intermediate-profitability range, explanatory power of both earnings capitalization model and balance sheet model reach the peak, there are no significant differences between them. In the low-profitability range (small or negative profitability), explanatory power of balance sheet model is larger than earnings capitalization model. In the high-profitability range, explanatory power of balance sheet model is less than earnings capitalization model.

Research limitations/implications – The results support that the role of BV is more stable in equity valuation. Moreover, this outcome provides reference for improving existing valuation model and setting accounting standard, and provides some empirical evidence for the practical application of BV in equity valuation.

Originality/value – Existing studies treat earnings as main variable of equity valuation, and BV is only added as a supplement. This paper compares roles of accounting earnings and BV in equity valuation, especially investigates the influence of BV in equity valuation, and fills up the deficiency in the related literature.

Keywords Equity valuation, Accounting data, Explanatory power, Vuong test

Paper type Research paper

1. Introduction

The roles of accounting data in equity valuation is an important theoretical basis for selecting valuation model in practice and the theoretical foundation for constructing or modifying valuation model.

The summary accounting data applied in equity valuation are mainly the accounting earnings from income statement and the book value (BV) of net assets from balance sheet. There is no agreement of opinion at all on the roles of accounting earnings and BV in equity valuation or the question why BV should be introduced into valuation model. With respect to theoretical study, Barth and Landsman (1995) think that both earnings capitalization model and balance sheet model hypothesize that the market is complete and perfect, therefore accounting earnings and BV are pricing variables which are mutually redundant, namely that they can be replaced by each other. Yee (2000) holds that the market is not complete or perfect, so both BV and accounting earnings should be the principal components of equity pricing; in other words, they should be mutually complementary rather than mutually exclusive. From the point of view of Chen and Zhang (2002), the valuation based on solely either

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accounting earnings or BV is tenable only under strict conditions. Empirical studies more regard BV as the supplementary variable of accounting earnings and believe it is the proxy variable of the liquidating value of a loss-making company, scale control variable and so on. By utilizing the three status hypotheses (control variable of scale difference, proxy variable of expected future normal earnings and proxy variable of the liquidating value of loss-making company) of net assets in equity valuation of a loss-making company, Collins *et al.* (1999) conduct empirical test and find that except the control variable of scale difference, the other two hypotheses are supported by empirical evidence. Existing empirical studies mainly focus on the BV in the situation of a loss-making enterprise or low profitability and have not yet paid real attention to the roles of accounting earnings and BV in equity valuation in case of normal profitability. To determine whether there is a substitutive or complementary relationship between accounting data in equity valuation, we should not only deeply analyze the relationship between accounting data but also analyze the internal relationship between accounting data and equity value from the perspective of economic meaning; it is wrong to simply reach a conclusion intuitively.

The paper first analyzes the dynamic relationships between such main accounting data as accounting earnings, BVs of net assets and returns on equity from the angle of valuation, then analyzes the internal relationship between accounting data and equity value from the perspective of accounting data's economic meaning and tests the explanatory powers of accounting data and BV and the incremental explanatory power (IEP) by applying earnings capitalization model, balance sheet model and simplified Ohlson model. The analyses find that either BV or accounting earnings may be a major variable determining the equity value and there is a substitutive relationship between them. The measurement of the explanatory powers of relevant accounting data with the coefficient of determination (R^2) of model suggests that the explanatory powers of accounting data are significantly different in different profitability ranges. There is not much difference between accounting earnings and BV in a steady state; however, in the low-profitability range, especially in the state of deficit, the explanatory power of BV is remarkably larger than that of accounting earnings, but in the high-profitability range, the explanatory power of BV is smaller than that of accounting earnings.

2. Theoretical analysis and study hypotheses

2.1 Accounting data and their interrelations

Accounting earnings are determined commonly by net assets' investment and enterprise's profitability, so there are interactive dynamic relationships between BV, profitability and accounting earnings. Accounting earnings are driven by net assets' investment and profitability, and there are profitability-driven relationships between them, i.e.:

$$x_t = BV_{t-1} \times q_t \tag{1}$$

where x_t is the accounting earnings at period t; BV_{t-1} is the BV of net assets at the beginning at period t; q_t is the profitability at period t.

This profitability-driven relationship introduces profitability in as an independent variable and reflects that accounting earnings are determined commonly by net assets' investment and profitability. BV shows the level of resource occupied by enterprise, and profitability embodies a firm-specific business technology. Burgstahler and Dichev (1997) think that the resource status of enterprise and how the resource is utilized is mutually independent and existing resource status cannot demonstrate its utilization

ability, namely that BV and profitability is theoretically independent and accounting earnings are the outcome of the combined action of BV and profitability. According to Hao *et al.* (2011), BV is orthogonal to profitability (q), and their information is mutually complementary in essence. However, BV is not orthogonal to accounting earnings, so is profitability; instead, BV exerts immediate impact on earnings, and profitability also has effect on earnings.

If the relationship between accounting data is understood as a profitability-driven relationship, its superiority embodies the internal interactive relationship between accounting data; resource investment level and business technology jointly determine the level of earnings and thereby have an effect on equity value. According to Formula 1, given earnings, there exist curve linear relationships between BV and profitability. In case profitability is higher than zero, there are inverse relationships between, BV and profitability; in case profitability is lower than zero, BV has a positive correlation to profitability. Supposing profitability remains constant, there is a linear relationship between BV and accounting earnings. If earnings are more than zero, BV has a positive correlation to earnings; if earnings are less than zero, BV shows a negative correlation to earnings. Besides, under the condition of constant BV, accounting earnings have a positive correlation to profitability, and when earnings are less than zero, this relationship will not change (see Figure 1 for details).

In Figure 1, curves a and b, respectively, show the iso-earnings curves of different levels of earnings in case of profitability higher than zero. The earnings level of curve b is generally higher than that of curve a, there is an inverse relationship between BV and profitability, and the BV corresponding to point B is higher than that at point C, but the profitability corresponding to point C is higher than that at point B; that is to say, in case of constant profitability, BV has a simultaneously increasing or decreasing relationship with earnings; for example, the BV and earnings at point A are higher than those at point C. When BV remains constant, earnings have a simultaneously increasing or decreasing relationship with profitability; for instance, the earnings and profitability at point A are higher than those at point B. Curves c and d, respectively, represent the iso-earnings curves of different levels of earnings in case of profitability lower than zero. The earnings level of curve c is higher than that of curve d, there is a positive relationship between BV and profitability, and the BV and profitability at point E are both higher than those at point F. When profitability remains constant, BV has an inverse relationship

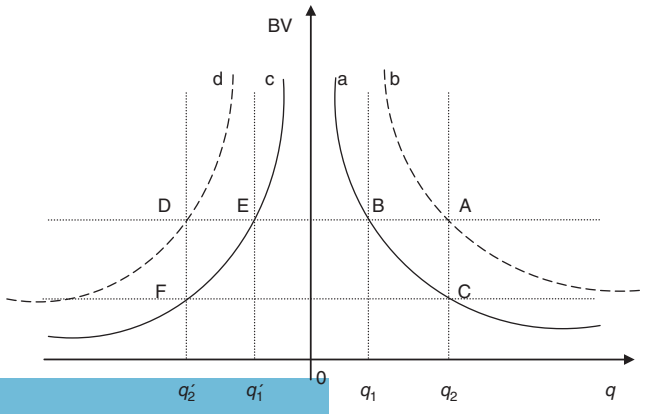

Figure 1.
Relation graph of given earnings, book value and profitability

with earnings, and the BV at point D is higher than that at point F, but the earnings at point D are less than those at point F. In case BV remains constant, earnings have a simultaneously increasing or decreasing relationship with profitability; for example, the earnings and profitability at point E are higher than those at point D.

2.2 Internal relationship between accounting data and equity value

2.2.1 Analysis from the view of value creation. From the view of value creation, an enterprise can be deemed as a combination of a set of resources and a firm-specific business technology. BV provides a measurement for existing resource of enterprise, and business technology is defined as the capability of enterprise to produce earnings by using its resource (Burgstahler and Dichev, 1997). Zhang (2000) holds that equity value rests with assets stock and operating efficiency. Equity value is related to existing assets stock, because existing assets reflect the resource owned by enterprise and its existing investment level and serve as the main basis for anticipating the inflow of economic benefit. Value depends on operating efficiency, because operating efficiency can be used to measure the capability of enterprise to create cash flow by exploiting existing assets, and meanwhile, investment activity is related to existing operating efficiency, which can reflect the guiding index of enterprise's decision on investment or disinvestment. Chen and Zhang (2002) think equity value relies on the information in two orthogonal dimensions: profitability and scale. The information of profitability can be extracted from profit statement (earnings) and balance sheet (BV), while scale can be determined commonly by investment that has happened (BV) and future investment opportunity. Hence, the intrinsic value of equity should be determined by the resource owned by enterprise and its technology of resource utilization, and accounting earnings, cash dividend and free cash flow are all not the drivers of enterprise value but the manifestation of outcome characteristics of enterprise value. Their basic relationships are shown in Figure 2.

As shown in Figure 2, the earnings of enterprise are determined commonly by the resource owned by enterprise and its capability of resource utilization, earnings are the fundamental influencing factor of dividend, and dividend finally influences equity value. Analysis above indicates that such indices as earnings and dividend, instead of being the fundamental drivers of equity value, are intermediate variables which are manifested as the most immediate factors influencing equity value on the one hand and the outcome indices or output indices of enterprise value on the other hand. The real drivers of equity value are enterprise's resource and its technology of resource utilization, or enterprise's level of investment in net assets and profitability if reflected

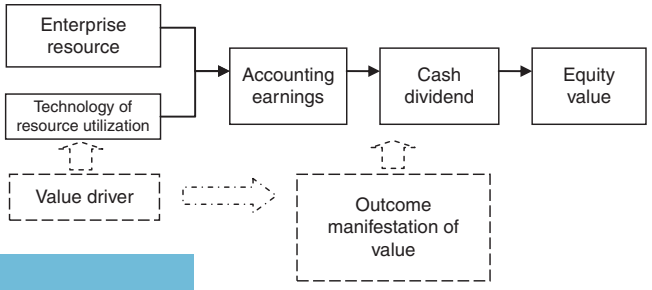

Figure 2.
The driver of equity value

by accounting data. This means that equity value is the function of profitability and scale (net assets) (Chen and Zhang, 2007), namely:

$$V = f(BV, q, g) \tag{2}$$

In addition, according to the principle of "capital-follow-profitability," profitability (operating efficiency) may guide investment decision making, namely that high profitability will lead to concentrated capital investment and the increase of investment level, whereas low profitability will result in disinvestment and the decrease of investment level. Therefore, profitability and growth potential determine future investment decision and thereby influence the cash flow of future operating activities. Finally, equity value is commonly determined by existing investment level, profitability and growth potential, i.e.:

$$V = f(BV, q, g) \tag{3}$$

2.2.2 Analysis from the view of model evolution. Although the theoretical bases of various valuation models are basically the same (Miller and Modigliani, 1961), different valuation models still reflect different relationships between accounting data and equity value after relevant assumed conditions are added.

In an earnings capitalization model, accounting earnings are the basic factor determining equity value. Its theoretical basis is: since accounting earnings are the basis for dividend distribution, together with the dividend irrelevance theory and the hypothesis of constant discount rate, equity value can be expressed as the capitalization of future earnings. Simplified earnings capitalization model represents equity value as the present value of perpetuity, and this simplified model is based on two stricter hypotheses: (1) n tends to infinity, meaning that the present value of final value can be ignored, and initial investment plays no role in valuation; (2) earnings are constant or follow "random walk," and the expected earnings are the accounting earnings at current period.

However, on the basis of earnings capitalization, different valuation models are formed through breaking down accounting earnings. In a steady state, accounting earnings can be broken down according to two different principles: addition principle and multiplication principle.

In the principle of addition, accounting earnings can be broken down into normal earnings and abnormal earnings (or residual income), i.e.:

$$x_t = x_t^N + x_t^a \tag{4}$$

where x_t is the accounting earnings at period t; x_t^N is normal earnings; x_t^a is abnormal earnings, i.e., residual income.

In this case, according to earnings capitalization model, equity value can be expressed as the discounted values, respectively, of normal earnings and abnormal earnings. If the present value of normal earnings is deemed as the BV of net assets, then it is residual income model. According to the residual income model, the BV of net assets and the present value of residual income jointly determine equity value. Although residual income model has the same theoretical basis with earnings capitalization model, due to the introduction of clean surplus relation, accounting earnings are translated into BV and residual income, and balance sheet and profit statement are integrated into one model. Similarly, the models of Ohlson (1995) and Feltham and Ohlson (1995, 1996) are all based on this. It is simple and clear to break down accounting earnings under the

principle of addition, and the BV of net assets can be introduced into model, but this principle fails to really interpret the causal relationship between accounting earnings and net assets' value.

In the principle of multiplication, accounting earnings are represented as the product of net assets' BV and profitability (ROE):

$$x_t = BV_{t-1} \times q_t \tag{5}$$

where x_t is the accounting earnings at period t; BV_{t-1} is the BV of net assets at the beginning at period t; q_t is the profitability at period t.

Now, according to earnings capitalization model, equity value can be expressed as the present value of the product of net assets' BV and profitability. If return on equity is equal to discount rate and equity value is equal to BV, then it is balance sheet model. Balance sheet model can also be considered as residual income model in case the residual income is zero, namely that when return on assets is equal to discount rate, residual income is zero. Multiplication principle is involved in Burgstahler and Dichev's (1997) model and Zhang's (2000) model.

The evolution of various models is shown in Figure 3.

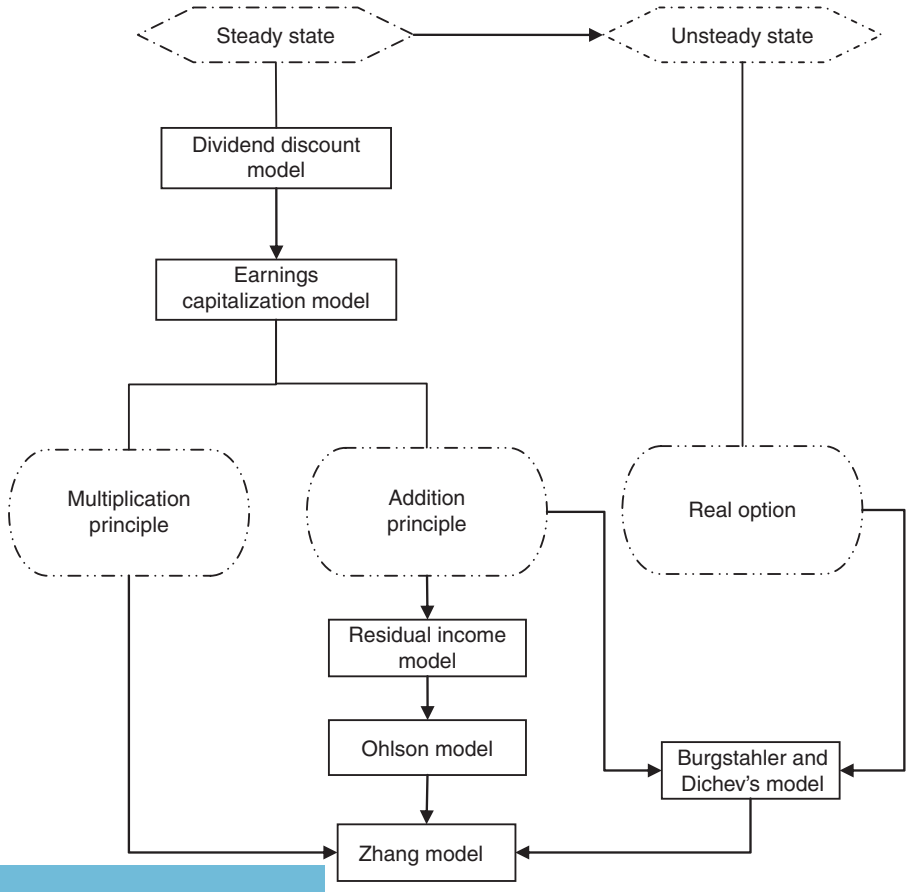

Figure 3.
Fundamental relationship between accounting data and equity valuation model

In a steady state, no matter how accounting earnings are broken down, the BV of net assets can be introduced into model; earnings capitalization model, balance sheet model and residual income model are theoretically consistent; the explanatory powers of all the models should have no significant difference; BV and accounting earnings are mutually substitutive. Though the conclusions reached by applying addition principle and multiplication principle are consistent, multiplication principle better reflects the internal causal relationship – profitability-driven relationship – between BV and accounting earnings.

In an unsteady state, the roles of accounting data in valuation models will change, mainly shown in the following aspects: on the one hand, enterprise is confronted with liquidation and unable to continue as a going concern, and n does not tend to infinity; on the other hand, the investment of enterprise no longer maintains the original level. In case of liquidation, n does not tend to infinity any longer, and enterprise is facing liquidation or restructuring during a short term, so the present value of final value should not be simply assumed as zero, and the role of final value in valuation should be considered; and the amount of final value is closely related to initial investment and BV. Furthermore, in line with the theory of real option, when an enterprise has a possibility of liquidation, the value of adaptive option will impact equity value. Burgstahler and Dichev's (1997) model and Zhang's (2000) model both introduce real option into valuation models and take into account the effect of decision flexibility on equity value. As a result, under the condition that the assumption of going concern is invalid and there is a possibility of liquidation, the value relevance of accounting earnings will be reduced, even to null. However, BV plays a particular role in such a case, so there is no simple substitutive relationship. According to "capital-follow-profitability," investment level have some correlations with profitability. When profitability is higher than market interest rate, enterprise may make additional investment, so there is growth option; when profitability is lower than market interest rate, enterprise may withdraw or reduce investment, so there is adaptive option. For this reason, in the situation with uncertainty, real option will influence equity value and the relationship between accounting data and equity value.

2.3 Study hypotheses

2.3.1 Roles of accounting data in valuation in a steady state. Based on different operating efficiencies and growth potentials, Zhang (2000) divides enterprises into three states: low-efficiency firms, steady-state firms and growth firms. Steady state refers to the condition of going concern, in which existing operating state remains unchanged. In the steady state, enterprise is expected to continue as a going concern with its existing scale, and there is no risk of operation discontinuation, but operating efficiency is not enough to judge its future growth capacity. For such enterprises, both put option and call option may be neglected. Thus according to Zhang's (2000) model, with regard to steady-state firms, accounting earnings belong to a significant explanatory variable, and valuation can be carried out by using simple earnings capitalization model; assuming the discount rate is constant, accounting earnings show a linear relationship with equity value. Moreover, in line with the relationship between accounting data, no matter whether it is static CSR or dynamic profitability-driven relationship, accounting earnings and BV can be mutually translated, and they are mutually substitutive. From the perspective of the driver of value creation, accounting earnings are the result of the combined action

of BV (investment level) and profitability. They reflect value creation and the result of value creation at different levels, so they are mutually substitutive in valuation. As a result, the following hypothesis is put forward:

H1. In the steady state, both accounting earnings and BV have relatively large explanatory power, and there is no significant difference.

2.3.2 Roles of accounting data in valuation in an unsteady state. In an unsteady state, because of the influence of real option's value, the relationship between accounting data and equity value will change. Low-efficiency enterprises are faced with greater possibility of operation discontinuation and smaller chance of expansion. As to these enterprises, the value of put option is an important component of equity value, whereas call option may be ignored. In compliance with Zhang's (2000) model, the equity value of a low-efficiency enterprise is composed of three parts: adaptation value of assets, that is, the value of enterprise in the state of liquidation or changing existing purpose; the present value of earnings of enterprise before changing existing purpose; and the value of call option of going concern. In the state of low efficiency, the values of the last two parts are comparatively small and insignificant, and equity value is largely from the adaptation value of assets. In case of liquidation, adaptation value is closely related to BV, so in the state of low efficiency, BV is more value-relevant than earnings, or we should say it has larger explanatory power. Besides, in the state of low efficiency, the enterprise is unable to continue as a going concern; under the effect of adaptive option, the role of value creation factor is lowered in valuation, whereas the role of value liquidation factor is increased; the value relevance, respectively, of accounting earnings and BV is reduced, but BV has larger explanatory power than accounting earnings; there is no simple complementary relationship between the two. Thus the following hypothesis is proposed:

H2. In the state of low profitability, the explanatory powers of accounting earnings and BV are both small, but BV has larger explanatory power than accounting earnings.

Growth enterprises have the potential of growth and high operating efficiency, thereby having the opportunity of growth. According to "capital-follow-profitability," enterprises with high profitability tend to have growth opportunity. With respect to these enterprises, the value of call option is very important, while put option may be ignored. According to Zhang's (2000) model, the equity value of a growth enterprise is composed of two parts – the present value of accounting earnings in the steady state and the value of future growth opportunity. The same with the condition in the steady state, both accounting earnings and BV have value relevance and explanatory power. Regarding the value of future growth, Chen and Zhang (2002), based on the deduction of Zhang's (2000) model, hold that accounting earnings have more influence on the value of investment opportunity. In addition, because an enterprise in the face of growth opportunity will be influenced or restricted by more factors other than accounting data, such as industrial policy, the prosperity degree of market, the risk preference of management, refinancing capacity and diminishing marginal returns, the explanatory powers of accounting earnings and BV will be lowered relatively. Therefore the following hypothesis is brought forward:

H3. In the state of high profitability, the explanatory powers of accounting earnings and BV are smaller than those in the steady state, but accounting earnings have a larger explanatory power than BV.

3. Study design

3.1 Main methods

3.1.1 Comparison of models' explanatory powers. Coefficient of determination (R^2) is the index of the combined influence of multiple independent variables on dependent variable. In a linear regression, the larger the coefficient of determination is, the larger the explanatory power of independent variable is in regard of dependent variable. During accounting studies, the coefficient of determination (R^2) of model is also frequently used to reflect the value relevance of accounting data (Lev, 1989; Easton *et al.*, 1992; Easton and Harris, 1991; Lo and Lys, 2000). By comparing the explanatory powers of earnings capitalization model and balance sheet model, the paper analyzes the value relevance, respectively, of accounting earnings and BV under different conditions.

3.1.2 Comparison of IEPs. The method of IEP was initially proposed and applied by econometric scholar Theil (1971). This method shows the explanatory power of a newly added variable mainly through calculating the change of model's coefficient of determination (R^2) after variable addition, i.e., through calculating the difference between the coefficients of determination ($\Delta R^2 = R^2_{New} - R^2_{Old}$) of two models. It is adopted by Easton (1985), Collins *et al.* (1997), Lu (1999), Zhang *et al.* (2007), Huang and Zhang (2012), etc., in their studies. By comparing earnings capitalization model and balance sheet model with simplified Ohlson model, the paper analyzes the IEPs of accounting earnings and BV.

3.1.3 Vuong test. Vuong (1989) thinks that if one model is closer to real function than another, the log likelihood of each individual acquired from this model should be significantly larger than that of another. Vuong test is the statistical measurement aiming at this assumption. It tests the difference between the explanatory powers of two models with the same explained variable (Dechow, 1994). Later Vuong test becomes an industrial standard.

The paper carries out Vuong test on the difference between the explanatory powers of different models (R^2) in order to analyze the different roles of accounting data in equity valuation.

3.2 Variables

3.2.1 Explained variable. Equity value (V_{it}). Burgstahler and Dichev's (1997) model takes the total market value of equity (MV_t), namely the product of the price per share and the number of outstanding shares at the year end, as the proxy variable of equity value. Collins *et al.* (1999) select the share price three months after the fiscal year as the explained variable. Hao *et al.* (2011) use the market value per share, i.e., the market value of ordinary share at the end of every fiscal year, as the proxy variable of equity value. In this paper, the price per share (P_{it}) on the date of balance sheet is taken as the explained variable.

3.2.2 Explanatory variables. Accounting earnings (x_{it}). The accounting earnings selected by Burgstahler and Dichev (1997) are the earnings prior to extraordinary items, i.e., the earnings after deduction of non-recurring profit and loss. Hao *et al.* (2011) take the earnings per share after non-recurring profit and loss are deducted from fully diluted earnings as the variable of accounting earnings, and the paper regards "the earnings per share after deduction of non-recurring profit and loss" as the proxy variable of accounting earnings.

Book value (BV_{it}). In consideration of the relationship between the BV per share and the earnings per share at the year end, Burgstahler and Dichev (1997) and

Hao *et al.* (2011) select the BV at the year beginning as the proxy variable. But according to balance sheet model, residual income model and Ohlson model, the explanatory variable should be the BV of net assets at the year end. In the paper, the net asset value per share at the year end is taken as the proxy variable of BV, and during sensitivity analysis, the BV at the year beginning is used as the proxy variable.

Profitability (q_{it}). Hao *et al.* (2011) take the quotient of the earnings before deduction of non-recurring profit and loss and the BV of net assets at the year beginning as the variable of profitability. The paper selects the quotient of "the earnings per share after deduction of non-recurring profit and loss" and the net asset value per share as the proxy variable of profitability.

See Table I for the details of variables concerned.

3.3 Models

To test the value relevance and explanatory power of accounting earnings, the following regression model is set up based on earnings capitalization model:

$$P_{it} = \alpha_0 + \alpha_1 x_{it} + \varepsilon_{1t} \tag{6}$$

where P_{it} is equity value; x_{it} is accounting earnings; α_0 is intercept term; α_1 is the regression coefficient of accounting earnings; ε_{1t} is disturbance term.

In order to test the value relevance and explanatory power of BV, the following regression model is established according to balance sheet model:

$$P_{it} = \beta_0 + \beta_1 BV_{it} + \varepsilon_{2t} \tag{7}$$

where P_{it} is equity value; BV_{it} is the BV of net assets; β_0 is intercept term; β_1 is the regression coefficient of BV; ε_{2t} is disturbance term.

For the purpose of testing the IEPs of accounting earnings and BV, the following regression model is established based on simplified Ohlson (1995)[1]:

$$P_{it} = \gamma_0 + \gamma_1 x_{it} + \gamma_2 BV_{it} + \varepsilon_{3t} \tag{8}$$

where P_{it} is equity value; x_{it} is accounting earnings; BV_{it} is the BV of net assets; γ_0 is intercept term; γ_1 is the regression coefficient of accounting earnings; γ_2 is the regression coefficient of BV; ε_{3t} is disturbance term.

3.4 Samples and data

3.4.1 Sample selection. The reform of non-tradable shares was launched in China at the beginning of 2004, and the stock market for small- and medium-sized companies

Description	Symbol	Meaning
Equity value	V_{it}	Explained variable; the closing price per share at the year end is selected
Accounting earnings	x_{it}	Explanatory variable; basic earnings per share after deduction of non-recurring profit and loss are selected
Book value	BV_{it}	Explanatory variable; net asset value per share at the year end is selected
Profitability	q_{it}	Return on equity after deduction of non-recurring profit and loss

Table I. Definitions of variables

was also established in 2004; therefore the paper selects the A-share listed companies of China in Shanghai and Shenzhen stock markets from 2004 to 2010. The data are largely from the market research database of GTA (www.gtarsc.com) and RESSET financial research database (www.resset.cn).

The procedure of sample selection is as follows: first, selecting all the A-share listed companies during 2004 and 2010; second, removing the samples of companies missing data; third, removing the listed companies in financial industry; fourth removing samples with negative asset; and finally, removing AB, AN, ABH, AH and AHN listed companies. After the selection following this procedure, the samples from 2004 to 2010 are 8,859 observed values, among which there are 1,628 observed values of loss-making enterprises, taking up 18.4 percent in the total number of samples (see Table II for details).

The paper conducts basic processing of data with software Excel 2007 and statistically analyzes them with software Stata 12.0.

3.4.2 Descriptive statistics. The descriptive statistics of main variables are indicated in Table III.

It can be known from the Table III that during the period of samples, the maximum share price at the year end is 299.74 Yuan, while the minimum is 1.21 Yuan, with the average being 12.54 Yuan and the median being 8.48 Yuan; the maximum earnings per share after deduction of non-operating profit and loss are 8.52 Yuan, while the minimum is −3.08 Yuan, with the average being 0.23 Yuan and the median being 0.17 Yuan; the maximum net asset value per share is 29.13 Yuan, while the minimum is 0.01 Yuan, with the average being 3.31 and the median being 2.93; the average profitability (return on equity) is −4.2 percent, with the median being 5.97 percent. The average, respectively, of share price at the year end, earnings per share and net asset value per share is higher than corresponding

Year	Samples (number)	Among which: profitable samples	Loss-making samples	Proportion of loss-making samples (%)
2004	1,103	907	196	17.8
2005	1,058	812	246	23.3
2006	1,099	892	207	18.8
2007	1,266	1,061	205	16.2
2008	1,324	1,015	309	23.3
2009	1,381	1,121	260	18.8
2010	1,628	1,423	205	12.6
Total	8,859	7,231	1,628	18.4

Table II. Annual distribution status of samples

	n	Maximum	Minimum	Mean	First quartile	Median	Third quartile
P_{it}	8,859	249.74	1.21	12.54	4.81	8.48	15.08
x_{it}	8,859	8.52	−3.08	0.23	0.03	0.17	0.39
BV_{it}	8,859	29.13	0.01	3.31	1.98	2.93	4.11
q_{it}	8,859	2.62	−134	−0.0420	0.0132	0.0597	0.1094

Table III. Descriptive statistics of main variables

median, so there may be relatively large abnormal values among the samples. To reduce the impact of abnormal values, we carry out 1 percent winsorize processing for the aforesaid variables during specific analysis. Besides, the above data indicate that the overall profit of sample enterprises is poor, with the average merely being −4.2 percent, showing a loss-making state.

4. Empirical analysis

4.1 Comparison of models' explanatory powers according to years

The explanatory powers and IEPs of accounting earnings and BVs in empirical models 6, 7 and 8 are compared and analyzed according to years, and Vuong test is conducted. See Table IV for specific results.

Observed from the data of all years in Table IV, the difference between the explanatory powers of models 6 and 7 is small in years other than 2007, and Vuong test is insignificant. Seen from the blended data of years, the explanatory powers of models 6 and 7 are 37.64 and 37.42 percent, respectively, with small difference and insignificant Vuong test. This result can partially prove the reasonability of the expectation of *H1*.

In addition, the overall explanatory power of model 6 ranges from 28.9 to 47.11 percent. Compared with the results of foreign scholars' relevant studies on the USA, the accounting earnings based on price model has a smaller overall explanatory power. For example, the explanatory power of Ely and Waymire (1999) is 44 percent, that of Francis and Schipper (1999) is 62 percent and that of Lev and Zarowin (1999) is 76 percent.

Meanwhile, it can also be found from Table IV that both BV and accounting earnings have IEPs, but there is no significant difference between the two. In terms of the analysis on blended data, the IEP of BV is 0.0799, and that of accounting earnings is 0.0821; the latter is slightly larger than the former. Additionally, there is no significant difference between the IEPs of BV and accounting earnings of all years.

The results mentioned above demonstrate that there is no significant difference between the explanatory powers of BV and accounting earnings with respect to equity value and they are mutually substitutive when used to explain equity value; accounting earnings are not more explanatory than BV. Though Ohlson (1995) model is added with the variable of BV, no larger IEP is brought forth. Similarly, no larger IEP is generated by adding accounting earnings into the BV model. As shown by the research conclusion of Myers (1999), the valuation based on Ohlson model is not superior to that only using BV.

4.2 Comparison of models' explanatory powers in case of different levels of profitability

When establishing the model of real option valuation, Zhang (2000) classifies the samples of profitable enterprises into three types, i.e., low efficiency, steady state and high growth, according to the level of profitability and growth potential. While analyzing the value relevance of accounting data in different states, Hao *et al.* (2011) also divide samples into three classes according to profitability (q_{it}), namely low, medium and high levels of profitability. For the purpose of comparing the explanatory powers and IEPs of accounting data in different states and in compliance with the methods of aforesaid scholars, the paper divides samples into three parts of subsamples: the first part is the samples with low profitability, denoted by q_L; the second part is samples in steady state, denoted by q_M; and the third part is samples with high profitability (high growth), denoted by q_H. The IEPs of BV and accounting earnings are

Table IV. Incremental explanatory powers of accounting data (according to years)

Years	Number of samples n	Explanatory power of model 6 R_1^2	Explanatory power of model 7 R_2^2	Explanatory power of model 8 R_3^2	Incremental explanatory power of book value $R_3^2-R_1^2$	Incremental explanatory power of accounting earnings $R_3^2-R_2^2$	Vuong test Z-statistic	Vuong test p-value
2004	1,103	0.3691	0.3466	0.4571	0.088	0.1105	0.8426	0.3995
2005	1,058	0.3397	0.2890	0.4073	0.0676	0.1183	1.4507	0.1469
2006	1,099	0.3914	0.3233	0.4451	0.0537	0.1218	2.1796**	0.0293
2007	1,266	0.5318	0.3717	0.5612	0.0294	0.1895	5.6754***	0.0000
2008	1,324	0.4246	0.3559	0.4817	0.0571	0.1258	2.2547**	0.0242
2009	1,381	0.4961	0.4624	0.5811	0.085	0.1187	1.1606	0.2458
2010	1,628	0.4410	0.4711	0.5390	0.098	0.0679	−1.2714	0.2036
Blended	8,859	0.3764	0.3742	0.4563	0.0799	0.0821	0.1907	0.8488

Notes: Model 6: $P_t = \alpha_0 + \alpha_1 x_t + \varepsilon_{1t}$; model 7: $P_t = \beta_0 + \beta_1 BV_t + \varepsilon_{2t}$; model 8: $P_t = \gamma_0 + \gamma_1 x_t + \gamma_2 BV_t + \varepsilon_{4t}$. R^2 is the coefficient of determination of model. Vuong test is Z-statistic and tests the difference between the explanatory powers of models 6 and 7

reflected by calculating the coefficients of determination of models 6, 7 and 8 (see Table V for specific results).

It can be known from Table V that: first, the explanatory powers both of accounting earnings and BV change along with profitability, but the change is not monotonic; instead, it rises first and then declines. When profitability is relatively low, the explanatory powers of both are small, as shown in Table V; in case of the steady profitability, the explanatory powers are maximized, exceeding 40 percent as shown in Table V; when profitability is high, the explanatory powers decrease, as shown in Table V. These indicate that the explanatory powers of accounting data in the steady state are the largest, verifying *H1* and *H2* and the first half of *H3*. Second, in the steady state, the accounting data have larger explanatory powers, and there is no significant difference between accounting earnings and BV, as shown in Table V; thus *H1* is verified. Third, in the state of low profitability, the explanatory power of BV is larger than that of accounting earnings, as shown in Table V; thus *H2* is verified. Fourth, in the state of high profitability, the explanatory power of accounting earnings is larger than that of BV, as shown in Table V; therefore *H3* is verified.

Furthermore, Luo and Qin (2003) analyze the non-linear relationship between accounting data with the method of grouping regression based on the level of profitability and select 2, 6 and 10 percent as threshold indices during grouping in order to reveal the explanatory powers of different accounting variables through comparison. Besides, according to RESSET database, the risk-free return rate in the market of China is about 2 percent, and the median and the third quartile of profitability (q_{it}) are exactly 6 and 10 percent, respectively. Thus, the paper divides samples into five parts based on the profitability lower than zero (deficit) and 2, 6 and 10 percent, denoted by q_i: $i = 1 \sim 5$; the explanatory powers and IEPs of accounting earnings and BVs of five different profitability samples are compared to reflect their respective value relevance (see Table VI for details).

The results in Table VI are basically consistent with those in Table V. The explanatory powers both of accounting earnings and BV change along with profitability, but the change is not monotonic; instead, it rises first and then declines. When profitability is relatively low, the explanatory powers of both are small, as shown in Table VI; in case of the steady profitability, the explanatory powers are maximized, exceeding 50 percent as shown in Table VI; when profitability is high, the explanatory powers decrease, as shown in Table VI. These indicate that the explanatory powers of accounting data in the steady state are the largest. In the steady state, the accounting data have larger explanatory powers, and there is no significant difference, as shown in Table VI. In the state of low profitability, the explanatory power of BV is larger than that of accounting earnings and more significantly larger in the state of deficit, as shown in Table VI. In the state of high profitability, the explanatory power of accounting earnings is larger than that of BV, as shown in Table VI.

Moreover, the paper also tests the IEP of accounting data in case of different levels of profitability. Except under the condition of low profitability when accounting earnings have no significant IEP, both BV and accounting earnings have IEPs in other cases. It is meanwhile found that along with the increase of profitability, the IEP of accounting earnings also rises, whereas that of BV declines, as shown by the comparison of IEPs in Tables V and VI, which is consistent with the test result of Chen and Zhang (2002).

Table V. Explanatory powers of accounting data in case of different levels of profitability (I)

Sample state	Number of samples n	Explanatory power of model 6 R_1^2	Explanatory power of model 7 R_2^2	Comparison of models' explanatory powers $R_1^2 - R_2^2$	Explanatory power of model 8 R_3^2	Incremental explanatory power of book value $R_3^2 - R_1^2$	Incremental explanatory power of accounting earnings $R_3^2 - R_2^2$
q_L	2,953	0.0150	0.0795	−0.0645	0.0811	0.0661	0.0016
Vuong test				−4.0953***		−4.3994***	−1.1176
				(0.0000)		(0.0000)	(0.2673)
q_M	2,953	0.4285	0.4440	−0.0155	0.4663	0.0378	0.0223
Vuong test				−1.2371		−5.1092***	−3.7941***
				(0.2160)		(0.0000)	(0.0001)
q_H	2,953	0.3892	0.3652	0.024	0.4216	0.0324	0.0564
Vuong test				1.5345		−4.7336***	−6.1013***
				(0.1249)		(0.0000)	(0.0000)

Notes: Model 6: $P_{it} = \alpha_0 + \alpha_1 x_{it} + \varepsilon_{1t}$; model 7: $P_{it} = \beta_0 + \beta_1 BV_{it} + \varepsilon_{2t}$; model 8: $P_{it} = \gamma_0 + \gamma_1 x_{it} + \gamma_2 BV_{it} + \varepsilon_{3t}$. R^2 is the coefficient of determination of model. Vuong test is Z-statistic, and the content in brackets is p-value

Table VI. Explanatory powers of accounting data in case of different levels of profitability (II)

Sample state	Number of samples n	Explanatory power of model 3-1 R_1^2	Explanatory power of model 3-2 R_2^2	Comparison of models' explanatory powers $R_1^2-R_2^2$	Explanatory power of model 3-3 R_3^2	Incremental explanatory power of book value $R_3^2-R_1^2$	Incremental explanatory power of accounting earnings $R_3^2-R_2^2$
q_1	1,628	0.0087	0.0430	−0.0343	0.0477	0.039	0.0047
Vuong test				−1.91		−2.4533	−1.5844
				(0.0561)		(0.0141)	(0.1122)
q_2	947	0.0724	0.0963	−0.0239	0.1016	0.0292	0.0053
Vuong test				−1.6243		−2.5016	−0.8944
				(0.1043)		(0.0124)	(0.3711)
q_3	1,867	0.3010	0.3106	−0.0096	0.3272	0.0262	0.0166
Vuong test				−0.7321		−3.4354	−2.6062
				(0.4641)		(0.0006)	(0.0092)
q_4	1,839	0.5370	0.5183	0.0187	0.5433	0.0063	0.025
Vuong test				1.9712		−2.0108	−3.7295
				(0.0487)		(0.0443)	(0.0002)
q_5	2,578	0.3797	0.3465	0.0332	0.4037	0.024	0.0572
Vuong test				2.0999		−3.7686	−5.7394
				(0.0357)		(0.0002)	(0.0000)

Notes: Model 6: $P_{it}=\alpha_0+\alpha_1 x_{it}+\varepsilon_{1t}$; model 7: $P_{it}=\beta_0+\beta_1 BV_{it}+\varepsilon_{2t}$; model 8: $P_{it}=\gamma_0+\gamma_1 x_{it}+\gamma_2 BV_{it}+\varepsilon_{3t}$. R^2 is the coefficient of determination of model. Vuong test is Z-statistic, and the content in brackets is p-value. q_1: $q_t<0$; q_2: $0\leqslant q_t<0.0_2$; q_3: $0.02\leqslant q_t<0.06$; q_4: $0.06\leqslant q_t<0.10$; q_5: $q_t>0.10$

5. Summary and conclusion

The paper first analyzes the internal relationships between accounting data and the internal relationship between accounting data and equity value. The analysis suggests that: first, the relationship between accounting earnings and BV of net assets can be expressed as dynamic profitability-driven relationship; which can show the relationship between accounting data and value creation in a clearer way; second, the relationship between accounting data and equity value takes on the characters of hierarchy and substitutability; because of the internal relationships between accounting data, accounting earnings reflect the outcome of value creation, while BV and profitability more embody the driver of value creation; they are the embodiments of the outcome and driver of value creation at different levels, so they are substitutive in equity valuation; that is to say, either accounting earnings or BV in combination with profitability can be used for valuation, but such a substitutability needs to be maintained in the steady state; in case there is any extreme condition of profitability, this substitutive relationship will not exist; the relationship between accounting data and equity value is state-contingent.

On the basis of the theoretical analysis mentioned above, the paper puts forward three study hypotheses, tests the explanatory powers of accounting earnings and BV in case of different levels of profitability and have the following findings. First, the explanatory powers of earnings capitalization model and balance sheet model change along with profitability. In the state of low profitability, the explanatory powers of accounting earnings and BV are both small; in the steady state (moderate profitability), the explanatory powers of accounting earnings and BV increase and reach the peak, i.e., exceeding 50 percent, when profitability ranges from 6 to 10 percent; however, as profitability further increases, the explanatory powers of accounting data decrease. Second, in the steady state, there is no significant difference between the explanatory powers of accounting earnings and BV, and both are mutually substitutive in equity valuation; in case of extremely low profitability, the explanatory power of BV is larger than that of accounting earnings, while in case of extremely high profitability, the explanatory power of accounting earnings is larger than that of BV. Third, as profitability increases, the IEP of BV declines, whereas that of accounting earnings increases.

The significances of the research conclusions herein are as follows. First, in the steady state, either simple earnings capitalization model or balance sheet model can be used for equity valuation since both are mutually substitutive; in practice, price-earnings ratio model (P/E model) and price-book ratio model (P/B model) have the same theoretical basis. Second, in the steady state, although certain IEPs may be generated for each other by adding accounting earnings and BV into the same model, such powers are relatively small; meanwhile, due to the causal relationship between accounting data, there is obvious correlation between BV and accounting earnings, therefore simply adding the two into one model may give rise to their failure to theoretically explain their respective role in valuation and lead to the problem of multicollinearity in empirical test. Third, in case of extremely low profitability, BV has comparatively large explanatory power and IEP, but its overall explanatory power is relatively small; hence, in such a case, BV has larger explanatory power than accounting earnings, but it is wrong to simply make valuation merely based on BV, and further study is necessary. Fourth, in case of extremely high profitability, accounting earnings has relatively large explanatory power and IEP, but its overall explanatory power is smaller than that in the steady state; therefore in such a case, it is also wrong to make valuation only based on accounting earnings, and further study is needed.

Note

1. According to Ohlson (1995), the constant term represents the value impact of "other information".

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Corresponding author
Dr Tiandong Wang can be contacted at: wtdong@vip.126.com