



The Value Relevance of Earnings and Book Value Using an Option-Style Equity Valuation Model: Evidence from Korea

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Abstract

The purpose of this paper is to investigate the value relevance of earnings and book value in security prices from 1982 to 2001 in Korean stock market. The study examines whether the accounting earnings and book value have a nonlinear relationship to equity value by using an option-style model of equity. The study uses an option-style model of equity value to test the hypothesis that earnings and book value have a nonlinear relationship to equity value by examining firms listed in the Korean stock market (7,928 firm-year observations). To this end, the paper performs analyses for all samples and across subsamples divided into loss firms and profit firms, and observes changes in relationships over the past twenty years. This paper reports three sets of findings. First, the value-relevance of accounting earnings differs between loss firms and profit firms. Second, Korean firms differently acknowledge accounting earnings and book value for equity valuation. Third, an option-style valuation model can explain the nonlinear relationship between equity value and accounting earnings/book value. The important contribution of the study is to show the nonlinear relationship between equity value and book value in the Korean stock market. And the empirical results of the paper reinforces the adoption of a new equity valuation model that explicitly recognized the option that firms have to adapt their resources to the alternative uses available to them.

Keywords: Accounting earnings, Book value, Value Relevance, Option-style model of equity value

1. Introduction

The paper investigates the value relevance of earnings and book value in security prices from 1982 to 2001. The study examines whether the accounting earnings and book value have a nonlinear relationship to equity value by using an option-style model of equity. The paper is motivated by different empirical results of studies on value relevance of earnings and book value. The study addresses two research questions; first, is equity value a linear function of earnings? Second, is equity value a linear function of book value? Prior studies (Hayn, 1995; Burgstahler and Dichev, 1997a; Zhang, 2000; Chen and Zhang, 2002) give a direct motivation to this paper. Since Ball and Brown's (1968) study, many others have demonstrated that equity value is related to earnings and book value (Lev, 1989; Ou and Penman, 1989; Barth, 1991; Easton and Harris, 1991; Lev and Thiagarajan, 1993; Penman, 1991; Ou and Penman, 1993; Dechow, 1994; Ohlson, 1995; Feltham and Ohlson, 1995; Penman, 1996; Barth and Kallapur, 1996; Collins et. al., 1997; Easton, 1999). These studies mainly rely on the equity valuation model, assuming the value of equity is a linear function of earnings and book value.

In the 1990s, new researches raise questions about assuming a linear relationship between equity value and earnings. For example, Hayn (1995) shows that earnings of loss firms are less informative about future prospects than profit firms because shareholders have a liquidation option. These results suggest that a relationship between equity value and earnings might not be a linear function across profit and loss firms.

Jan and Ou (1994) also document a nonlinear equity value-earnings relationship across profit and loss firms. More strikingly, they find that since firms have the option to liquidate, the relationship between earnings and equity value is reliably negative for loss firms: the more negative a firm's earnings per share, the higher its equity value. These studies do not, however, suggest that a new equity accounting information model can reflect the option of liquidating. Burgstahler and Dichev (1997a) develop a new equity valuation model that explicitly recognizes the option that firms have to adapt their resources to the alternative uses available to them. They contend that the *ex ante* value of the option should be reflected in equity value, and find that equity value is a nonlinear function of both earnings and book value across firms. They divide their sample into three even groups to test nonlinear function but are unable to determine the

inflection point. Zhang (2000) and Chen and Zhang (2002) continue this research, also documenting a nonlinear relationship between equity value and earnings using an option-style model of equity value. In Korea, however, research about option-style valuation models and its relevance to earnings, book value, and equity value is still in the early stages, as demonstrated by the brevity of this paper's bibliography.

The study uses an option-style model of equity value to test the hypothesis that earnings and book value have a nonlinear relationship to equity value by examining firms listed in the Korean stock market. To this end, this study uses the following three tests. First, the paper investigates whether a linear relationship exists between equity value and earnings for firms listed in Korean stock markets. For this test the study uses a conventional simple linear regression model of equity value and earnings. Second, the paper uses a multiple linear regression model of equity value and earnings/book value to investigate relative value-relevance between earnings and book value. Third, the study uses a piecewise linear regression model to calculate the nonlinear relationship between equity value and earnings/book value.

The paper performs analyses for all samples and across subsamples divided into loss firms and profit firms, and observes changes in relationships over the past twenty years. For the third analysis, the study divides the sample into loss firms, profit firms, and earnings management firms. This paper reports three sets of findings. First, the value-relevance of accounting earnings differs between loss firms and profit firms. Second, Korean firms differently acknowledge accounting earnings and book value for equity valuation. Third, an option-style valuation model can explain the nonlinear relationship between equity value and accounting earnings/book value.

The rest of the paper proceeds as follows. Section 2 outlines previous recent studies that investigate the value-relevance of earnings and book values. Section 3 discusses the hypothesis and valuation models used in this study. Section 4 discusses the results of this study regarding the linear/nonlinear relationship between equity value and earnings/book value from 1982 to 2001, While Section 5 concludes.

2. Literature Review

After Ball and Brown's (1968) research, many studies have examined the relevance of accounting information and firms' equity. Most studies conclude that earnings contain information and that a linear relationship exists between accounting information and a firm's equity (Lev, 1989; Ou and Penman, 1989; Barth, 1991; Easton and Harris, 1991; Lev and Thiagarajan, 1993; Penman, 1991; Ou and Penman, 1993; Dechow, 1994; Ohlson, 1995; Feltham and Ohlson, 1995; Penman, 1996; Barth and Kallapur, 1996; Collins, Maydew and Weiss, 1997; Easton, 1999). However, compelling studies performed in the 1990s raise questions about this supposed linear relationship between a firm's earnings and equity. These questions arise mainly because of the sudden change in the world economic environment in the 1990s. This sudden change cause some professionals and researchers to recognize that accounting information has little relevance to the evaluation of a firm's equity value.

These recent researches can be classified as studies on the decreased relevance of earnings in equity valuation, studies on the increased relevance of book value in equity valuation, and studies on the relevance of earnings in equity valuation.

2.1 Studies on the Decreased Relevance of Earnings in Equity Valuation

Many studies of financial market performed 1990s have focused on the relationship between accounting information and stock price. This type of researches has reported a positive and linear relationship between accounting information and stock price. Hayn (1995), Amir and Lev (1996), Lev (1989), and Basu (1997) criticize these results.

Hayn (1995) separate firms into loss firms (those reporting losses) and profit firms (those reporting profits). She finds a much weaker cross-sectional return-earnings relationship for loss firms than for profit firms, and claims this weaker relationship is based on the common market perception of losses being transitory. Hayn (1995) suggests that the price-earnings relationship might not be homogeneous across profit and loss firms. Hayn's (1995) study is very important because it raises an objection to the assumption of linearity that has been commonly recognized for over three decades. Amir and Lev (1996) examine the value-relevance of independent cellular companies' financial and nonfinancial information to investors. They found that, on a stand-alone basis, financial information (including earnings, book values, and cash flows) is largely irrelevant to stock prices. Lev (1989) suggests that while investors apparently use earnings, the usefulness of earnings is rather limited, indicated by the weak and temporally unstable contemporaneous correlation between stock returns and earnings and by the very modest contribution earnings make to predicting stock prices and returns. Basu (1997) studies the conservatism principle and the asymmetric timeliness of earnings. He finds that because of accounting's definition of conservatism, contemporaneous sensitivity of earnings exhibited less persistence to negative returns in terms of an earnings-return relationship.

2.2 Studies on the Increased Relevance of Book Value in Equity Valuation

In the 1990s, researchers published results opposing previous research; they explained declining value-relevance of earnings based on increased value-relevance of book value (Penman, 1991; Ou and Penman, 1993; Kim, 1994; Collins

et al., 1997; Barth et al., 1998). Penman (1991) evaluates the accounting rate of return (ROE) as both a profitability indicator and a risk indicator. Using ROE for American firms over the 18-year period from 1969 to 1986, he finds a positive relationship between stock rates-of-return and ROE. Ou and Penman (1993) try to apply Ohlson's (1995) valuation model to find an accounting variable that explains the relationship among earnings, dividends, and stock prices. They find that apart from ROE, financial statement variables have little relevance to stock prices. They also find that appropriate division of data by financial distinction results in a higher return of a stock price's incremental explanatory power.

Collins et al. (1997) investigate systematic changes in the value-relevance of earnings and book values over time and produce three primary findings. First, contrary to claims in the professional literature, the combined value-relevance of earnings and book values have not declined over the previous 40 years, and in fact appeared to have increased slightly. Second, while the incremental value-relevance of 'bottom line' earnings has declined, it has been replaced by an increasing relevance of book values. Finally, he finds that much of the shift in value-relevance from earnings to book values could be explained by an increasing frequency and magnitude of one-time items, an increasing frequency of negative earnings, and changes in average firm size and intangible intensity across time.

Barth et al. (1998) test predictions that pricing multiples on, and incremental explanatory power of, book value (net income) would increase (decrease) as financial health decreases. Their empirical results are largely based on inclusion of controls for industry, size, return-on-equity, and volatility of equity returns. They find that equity book value and net income multiples and incremental explanatory power varies predictably across three sample industries that they have selected based on the likelihood of unrecognized intangible assets. Francis and Schipper (1999) investigate the value-relevance of financial accounting information to investors in the United States. Their analyses indicate that returns on perfect foresight trading strategies based on earnings signs and magnitudes, on levels and changes in earnings and book values, and on an assortment of fundamental signals decreased from 1952 to 1994.

They find the explanatory power that earnings levels and changes have on returns have decreased greatly over time. In contrast, they find no evidence of a decline in the explanatory power that book values of assets and liabilities for market equity values have on the explained variability of balance sheet relationships or the relationship between book value and earnings. Lev and Zarowin (1999) document a systematic decline from 1966 to 1977 in the usefulness of financial information to investors, manifested by a weakened association between capital market values and key financial variables (earnings, cash flows, and book values). They conclude that the main reasons for this decline in usefulness are increasing rates and impacts of business change and inadequate accounting treatment of change and its consequences. They link change empirically to reduced informativeness of financial data. In Korea, Jang et al. (2002) examine the value-relevance of accounting information. They compare the relevance of book values versus reported earnings. Their results indicates that overall relevance of book value and earnings increased from 1981 to 2000 and that the incremental explanatory power of book values increase, while that of earnings decrease.

2.3 Studies on the Relevance of Accounting Income and Equity Valuation

Some research has investigated why value-relevance of earnings has decreased while value-relevance of book values has increased in equity valuation, in terms of income and loss value-relevance.

Collins et al. (1999) conclude that including the book value of equity in valuation specifications eliminates the negative relationship. Their results do not support the hypothesis that the importance of book value in cross-sectional valuation stems primarily from its role as a control for scale differences. Rather, their results are consistent with the hypothesis that book value serves as a general value-relevant proxy for expected future normal earnings for loss firms, and as a proxy for abandonment options for loss firms most likely to cease operations and liquidate. Collins et al. (1999) find that in profit firms, earnings are the value-relevant factor, while book values serve that function in loss firms.

In Korea, Kim (2003) hypothesizes that since shareholders might have liquidation options when losses are expected to continue, listed firms' recorded losses are less informative than their profits regarding their future business prospects. His empirical results support this hypothesis. Both the explanatory power and the magnitude of earnings response coefficients from previous studies (an increase in measured information contents of earnings being proportional to the length of the accumulation period) are related to reduce frequency in aggregate losses. His results support Hayn (1995), but in most cases, Kim (2003) finds the Korean stock market to have a much lower magnitude of earnings response coefficients and explanatory power of the earnings and return relationship than the American market.

The papers discussed above have some important implications. First, whether intended or not, they document that value-relevance factors differ between profit and loss firms; previous studies did not examine this idea. Second, although they assume a linear relationship between accounting information and equity value and test their hypotheses using a linear valuation model, they suggest that there is a need for a nonlinear model that can more precisely explain the relationship between accounting information and equity value.

2.4 Studies on the Nonlinear Relevance of Accounting Income and Book Value in Equity Valuation

Since Ball and Brown (1968) published their paper, most financial market studies have used the linear valuation model, which assumes a linear relationship between earnings and equity value. The business environment in the real world, however, is not certain; decision makers such as CEOs are always open to the options of liquidating, delaying, or expanding their business. Recent studies have demonstrated that the linear assumption used in Ohlson (1995) and Feltham and Ohlson (1995) do not reflect the real world.

Burghstahler and Dichev (1997a) develop and test an option-style valuation model. Their main prediction is that equity value would be a convex function of both earnings and book value, where the function depends on relative values of earnings and book value. They find that when earnings/book value is low, a firm is more likely to exercise its option to adapt its resources to a superior alternative use, and book value becomes the more important determinant of equity value. Test results from a variety of empirical specifications are consistent with this convexity prediction. Yee (2000) incorporates adaptation into Ohlson (1995)'s residual income valuation framework and obtains an adaptation-adjusted valuation formula. Although the model is very basic, it makes two predictions consistent with phenomena reported in the empirical literature: earnings convexity and complementarity. Chen and Zhang (2002) examine the valuation roles of earnings and book values as well as cross-sectional differences in valuation properties, employing a real options-based valuation model. They find that as profitability increased, the value impact of earnings increases, whereas that of book value decreases and eventually become negative; the explanatory power of earnings increases, and that of book value decreases monotonically with profitability. The two accounting measures behave as valuation substitutes within a certain intermediate-profitability range.

The linear assumptions used in these studies differ from those in Ohlson (1995) and Feltham and Ohlson (1995). Ohlson (1995) and Feltham and Ohlson (1995) use an equity valuation model that assumes a linear relationship between accounting variables and equity value, whereas the option-based valuation models do not. Burghstahler and Dichev (1997a), Yee (2000), and Chen and Zhang (2002) emphasize that since option-based models are able to incorporate a firm's option to adapt its resources to alternative use, they can reflect a real world business environment better than linear valuation models. They also find that the relationship between accounting variables and equity values is nonlinear.

3. Hypothesis and Research Design

3.1 Study Hypothesis

To investigate whether the accounting earnings and book value have a nonlinear relationship to equity value, we test the following hypotheses;

Hypothesis 1 (H-1): Equity value is a linear function of earnings.

Hypothesis 2 (H-2): Equity value is a linear function of earnings, controlling for book value.

Hypothesis 3 (H-3): Equity value is a linear function of book value, controlling for earnings.

The first hypothesis is to investigate whether firms have a linear relationship between equity values and accounting earnings. The second and third hypotheses are to investigate relative value-relevance and nonlinear relationship between equity value and accounting earnings/book value.

3.2 Empirical Model for Hypothesis 1

We test H-1 using equation (3-1), replicating the results of Jan and Ou (1994) and Collins et al. (1999) with our sample of loss firms, profits firms, and overall firms from 1981 to 2001, using our earnings variables and equation (3-1), for example, the simple earnings capitalization model is as following:

$$P_t = b_1 + b_2 E_t / S_t + \varepsilon \quad (3-1)$$

P_t : stock price three months after fiscal year t

E_t / S_t : earnings per share in period t

S_t : number of shares outstanding at the end of year t

ε : error term

Next we test H-1 using equation (3-2). Collins et al. (1999) run the following multiple capitalization models separately for profit firms, loss firms, and overall firms, but we actually test equation (3-3) using dummy variable (D_t). In equation (3-3) if $E_t \geq 0$, $D_t = 1$, otherwise $D_t = 0$.

$$P_t = b_1 + b_2 E_t / S_t + b_3 BV_{t-1} / S_t + \varepsilon_t \quad (3-2)$$

BV_{t-1} : the book value of equity per share at the end of year t-1

$$P_t = b_1 + b_2 E_t / S_t + b_3 BV_{t-1} / S_t + b_4 D_t + b_5 D_t * E_t / S_t + b_6 D_t * BV_{t-1} / S_t + \varepsilon \quad (3-3)$$

D_t : dummy variable (if $E_t \geq 0$, $D_t=1$, otherwise $D_t=0$)

3.3 Empirical Model for Hypothesis 2

To test H-2 and H-3, we replicate Burghstahler and Dichev's (1997a) empirical model. The tests for H-2 and H-3 are derived from an empirical version of equation (3-4), expressing the market value of equity (V) as a function of both book value (BV) and earnings (E). In this equation, BV is a proxy for adaptation value and E is proxy for recursion value.

$$V_t = b_1 BV_t + b_2 E_t + \varepsilon_t \quad (3-4)$$

Where ε_t is a normally distributed error term with mean zero and unspecified variance. Equation (3-4) approximates market value of equity for a given firm at time t as a linear combination of book value and expected earnings at time t . As E becomes extremely low relative to BV , BV becomes the sole determinants of V and b_2 approaches zero while b_1 approaches unity. In contrast, as E becomes extremely high relative to BV , E becomes the sole determinant of V and b_1 approaches zero while b_2 approaches the earnings capitalization factor. However, to test H-2 and H-3, equation (3-4) must be operationalized in a form that provides a nonlinear relationship so that the coefficients of BV and E may vary with the level of E relative to BV .

Tests for H-2 require a constant book value while testing for the incremental effects of earnings, and tests for H-3 require constant earnings while testing for the incremental effects of book value.

To test for the nonlinear form implied by H-2 and H-3, we divide equation (3-4) by BV_{t-1} as the measure of adaptation value to obtain equation (3-5); we divide equation (3-4) by E as the measure of recursion value to obtain equation (3-6).

$$\begin{aligned} V_t/BV_{t-1} &= b_1 BV_{t-1}/BV_{t-1} + b_2 E_t/BV_{t-1} + \varepsilon^* \\ &= b_1 + b_2 E_t/BV_{t-1} + \varepsilon^* \end{aligned} \quad (3-5)$$

$$\varepsilon^* = \varepsilon/BV_{t-1}$$

$$\begin{aligned} V_t/E_t &= \gamma_1 BV_{t-1}/E_t + \gamma_2 E_t/E_t + \varepsilon^{**} \\ &= \gamma_2 + \gamma_1 BV_{t-1}/E_t + \varepsilon^{**} \end{aligned} \quad (3-6)$$

$$\varepsilon^{**} = \varepsilon/E_t$$

The following variables are used in the empirical tests:

- ① P_t : Stock price three months after fiscal year t
- ② V_t : Market value of equity (stock price 3 months after fiscal year t) \times (number of shares outstanding at the end of year t)
- ③ BV_{t-1} : the book value of equity per share at the end of year $t - 1$
- ④ E_t : Earnings in period t
- ⑤ S_t : Number of shares outstanding at the end of year t

We perform a piecewise linear regression to test H-2 and H-3. In doing so, we control book value and earnings separately and then divide samples into groups as follows:

(1) Controlling for book value of equity

- ① Divide all firms into three equal groups (Burghstahler and Dichev 1997a).
- ② First divide all firms into profit firms and loss firms, and then divide profit firms into three equal groups (Hayn 1995).
- ③ First divide all firms into a group of earnings management and others, and then divide the others into profit firms and loss firms (Burghstahler and Dichev 1997b; Song et al. 2004).

(2) Controlling for accounting earnings.

- ① Divide all firms into three equal groups (Burghstahler and Dichev 1997a).
- ② Divide all firms into two equal groups.
- ③ Divide all firms into a group of earnings management and others (Burghstahler and Dichev 1997b; Song et al. 2004).

3.4 Variable Definition

The paper defines the variables used in the empirical analysis as follows:

- ① P_t : The firm's stock price 3 months after the end of fiscal year t , where year t is the event year.
- ② V_t : Number of shares outstanding at the end of year t times the stock price per share 3 months after the end of fiscal year t .

- ③ BV_{t-1} : Book value at the end of year t
- ④ E_t : Income available to common stockholders in year t .
- ⑤ S_t : Total number of shares outstanding in year t .

4. Empirical Results

4.1 Sample Selection and Data Source

The paper obtains all necessary data from the KIS-FAS and KISRI databases. These data sets span the 20-year period from 1981 to 2001. During the process of sample selection, the study includes firms with stock prices, book values, earnings, and other financial data sufficient for empirical analysis, but the paper excludes financial banking business firms due to administrative issues. Table 1 describes the sample selection and data sources.

Insert <Table 1> about here

4.2 Relationships among Earnings per Share, Book Value per Share, and Stock Prices

4.2.1 Descriptive Statistics

Table 2 presents descriptive statistics for the sample of earnings per share, book value per share, and stock prices per share. The paper identifies 7,928 firm-year observations for the period 1981–2001. Total means of (P_t) is 19,844.40, and its highest value is in 1994. Total means of (E_t/S_t) is 840.11; its highest value is in 1988, and it has negative (-) values in 1997 and 1998. Total means of (BV_{t-1}/S_t) is 20,397.28; its highest value is in 2000.

Insert <Table 2> about here

4.2.2 Multiple Regression Analysis Results

The study divides the total number of firms into profit firms, loss firms, and total firms to perform a simple linear regression between (P_t/S_t) and (E_t/S_t) . Table 3 presents results for individual year regressions; (E_t/S_t) is significantly related to (P_t/S_t) in total firms. The simple regression analysis indicates that total firms earnings are significantly related to stock price. On average, adjusted R^2 and coefficient (b_2) decline in the overall period; these results support results in Collins et al. (1997), Han (1998). Table 3 indicates that in profit firms, earnings are significant variables of value-relevance, while loss firms exhibit decreased significance. These results also support the results of Hayn (1995) and Collins et al. (1999).

Insert <Table 3> about here

Table 4 shows the results of multiple regressions among earnings per share, book value per share, and stock price. The paper includes book value in the multiple regressions to test relative value-relevance between earnings per share (E_t/S_t) and book value per share (BV_{t-1}/S_t) in profit and loss firms. As Table 4 indicates, profit firms have coefficients on earnings per share (E_t/S_t) at a 5 and 1% level of significance in the term of 14 years, 1982–1991, 1992–2001, and 1982–2001, and the coefficients on book value per share (BV_{t-1}/S_t) had a 1% level of significance in the term of 4 years, 1992–2001 and 1982–2001. Loss firms, however, have insignificant coefficients on earnings per share except in the terms of 1987 and 1992, but have coefficients on book value per share of a 5 and 1% level of significance in the term of 8 years, 1992–2001 and 1982–2001. These results suggest that in profit firms, earnings per share is a significant value-relevant factor, while in loss firms, book value per share is relatively more significant than earnings per share. These results also support those of Collins et al. (1999).

Insert <Table 4> about here

Figure 1 graphically represents the findings of multiple regressions; the solid line shows the results of a simple linear regression of earnings per share and stock prices per share, and the dotted line shows those of a multiple regression among earnings per share, book value per share, and stock prices in profit firms and loss firms by using dummy variables that divide total firms into profit firms and loss firms.

Figure 1 shows the simple linear regression results in a steeper coefficient slope for earnings per share in profit firms than in loss firms. The multiple regression results in a steeper coefficient slope for earnings per share in profit firms than in loss firms (profit firms: 4.55, loss firms: 0.16). In contrast, the coefficient slope is steeper for book value per share in loss firms than in profit firms (profit firms: 0.02, loss firms: 0.12).

Insert <Figure 1> about here

The results of the simple and multiple regressions allow the paper to conclude that H-1 (equity value is a linear function of earnings) is not supported. Therefore, the next part of the research focuses on whether stock price is a nonlinear function of earnings and book value.

4.3 Nonlinear Function Tests

The study tests simple linear regression and piecewise linear regression analysis, controlling for book value and

earnings separately. Prior to the tests, the paper eliminates extreme data values; even with this elimination (controlling for book value: 7,928, controlling for earnings: 6,458), outliers are still present in samples. Therefore, the study eliminates samples greater than ROE (earnings/book value) = ± 1

4.3.1 Descriptive Statistics

Table 5 presents descriptive statistics for earnings controlling for book value (E_t/BV_{t-1}) and book value controlling for earnings (V_t/BV_{t-1}). The paper identifies 7,639 (E_t/BV_{t-1}) and 6,345 (V_t/BV_{t-1}) firm-year observations for the period from 1981 to 2001. The total means of (E_t/BV_{t-1}) are 0.06, and all samples are positive except for 1998. Total means of (V_t/BV_{t-1}) are 1.42, and are below 1 in 6 of the 20 years. Total means of (BV_{t-1}/E_t) and (V_t/E_t) were 25.69, 27.01, and all samples are positive because all negative earnings are eliminated.

Insert <Table 5> about here

4.3.2 Value Relevance of Earnings, Controlling for Book Value

4.3.2.1 Simple Linear Regression Analysis

Table 6 displays earnings (after controlling for book value) value-relevance calculated using a simple linear regression model. Earnings coefficients are positively significant at a level of 1% in 19 of 20 years. These results are consistent with most financial market research (e.g., Burgstahler and Dichev 1997 a; Chen and Zhang 2002).

Insert <Table 6> about here

4.3.2.2 Piecewise Linear Regression Analysis

4.3.2.2.1 Piecewise Linear Regression: Dividing E_t/BV_{t-1} into Three Equal Groups

Table 7 displays the results for the piecewise linear regression. It serves as a test of the predicted nonlinear earnings value-relevance because slopes and intercepts of the regression line are able to vary with the magnitude of E_t/BV_{t-1} . Table 7 shows estimated coefficients for three ranges of E_t/BV_{t-1} to provide a piecewise linear approximation of the nonlinear earnings value-relevance. The study divides the E_t/BV_{t-1} into three parts with equal numbers of samples. Dummy variables D_M and D_H indicate the middle and higher profit firm group of E_t/BV_{t-1} .

Coefficients reported in Table 7 represent the total intercept and slope coefficients for the middle group (i.e., b_1+b_2 for the intercept and b_4+b_5 for the slope) and the total coefficients for the higher profit group (i.e., b_1+b_3 for the intercept and b_4+b_6 for the slope). The t-statistics in Table 7 show that b_5 are insignificantly positive, but b_6 are significantly positive (1%, 5% level of significance) in 19 of 20 years. These results suggest that slopes do not differ between the lower firms and middle firms groups, but there is a significant slope difference between the lower firms and higher firms groups.

Insert <Table 7> about here

4.3.2.2.2 Piecewise Linear Regression Analysis: Dividing E_t/BV_{t-1} into Two Equal Groups of Profit Firms and One Loss Firms Group

Table 8 displays how the paper divides the E_t/BV_{t-1} into two equal earnings groups and one loss group. Dummy variables D_M and D_H , indicate the lower profit ranges and higher profit ranges of E_t/BV_{t-1} . Coefficients reported in Table 8 represent the total intercept and slope coefficients for the lower profit group (i.e., b_1+b_2 for the intercept and b_4+b_5 for the slope) and the total coefficients for the higher profit group (i.e., b_1+b_3 for the intercept and b_4+b_6 for the slope).

The t-statistics in Table 8 indicate that b_5 are significantly positive (1%, 5% level of significance) in 6 of 20 years, and b_6 are significantly positive (1%, 5% level of significance) in 19 of 20 years. These results suggest that slopes do not differ between loss firms and low profit firms groups, but a significant difference appeared in slopes between loss firms and higher profit firms groups.

Insert <Table 8> about here

4.3.2.2.3 Piecewise Linear Regression Analysis: Dividing All Data into Three Equal Groups according to the Magnitude of Earnings/Market Value

The study performs piecewise linear regression by dividing all data into three groups of equal numbers according to the magnitude of earnings/market value of equity. This serves as a test of the predicted nonlinear earnings value-relevance because slopes and intercepts of the regression line are able to vary with the magnitude of earnings management.

Figure 2 shows the distribution of annual income scaled by market value of equity from 1982 to 2001. Distribution interval widths are 0.00002 and a red line marks the position of zero on the horizontal axis. Bar height represents the number of observations in a given earnings interval.

The histogram displays a single peaked, bell-shaped distribution that is relatively smooth except in the area of zero

earnings; earnings slightly less than zero occurred much less frequently than expected given the smoothness of the remainder of the distribution and earnings slightly greater than zero occurred much more frequently than expected. This phenomenon is consistent with the results of Burgstahler and Dichev (1997b); Burgstahler and Dichev (1997b) assume an interval range of 0 to 0.00003 to manage earnings. The paper assumes a high probability that earnings management data would fall in the interval range of 0 to 0.00003; therefore, the real earnings are not profit but loss.

Insert <Figure 2> about here

Coefficients reported in Table 9 represent the total intercept and slope coefficients for the earnings management firms group (i.e., b_1+b_2 for the intercept and b_4+b_5 for the slope) and the total coefficients for the higher profit firms group (i.e., b_1+b_3 for the intercept and b_4+b_6 for the slope).

The t-statistics in Table 9 indicate that b_5 are significantly positive (1%, 5% levels of significance) in 18 of 20 years, and b_6 are significantly positive (1%, 5% levels of significance) in all 20 years. The loss firms group has a negative coefficient slope, and the earnings management firms and higher profit firms groups have a positive coefficient slope. The earnings management firms group has a particularly steep coefficient slope, which is steeper than that of higher profit firms group.

These results suggest a significant difference in slopes between loss firms and earnings management firms groups, as well as between loss firms and higher profit firms groups. Therefore, market value and earnings controlling for book value must have a nonlinear relationship.

Insert <Table 9> about here

In summary, the results do not support H-2, which states that equity value is a linear function of earnings, controlling for book value. This suggests that equity value is a nonlinear function of earnings, controlling for book value, which is consistent with the results of Burgstahler and Dichev (1997a), Zhang (2000), and Chen and Zhang (2002).

4.3.3 Value Relevance of Book Value, Controlling for Earnings

4.3.3.1 Simple Linear Regression Analysis

Table 10 displays the relevance of book value (after controlling for earning) using a simple linear regression model. It shows that book value coefficients are positively significant at a 1% level in all 20 years, which is consistent with results of most financial market research (e.g., Burgstahler and Dichev 1997a; Chen and Zhang 2002). Table 10 also shows that estimated R^2 increases over time (1982–1991: 0.43 < 1992–2001: 0.50). These results support those of Collins et al. (1997), Han (1998), who reports that the value relevance of book value has increased over 40 years.

Insert <Table 10> about here

4.3.3.2 Piecewise Linear Regression Analysis

4.3.3.2.1 Piecewise Linear Regression Analysis: Three Equal Groups

Table 11 displays the results of the piecewise linear regression. It serves as a test of predicted nonlinear earnings value-relevance because slopes and intercepts of the regression line are able to vary with the magnitude of BV_{t-1}/E_t . Table 11 shows the estimated coefficients for three ranges of BV_{t-1}/E_t to provide a piecewise linear approximation of the nonlinear earnings value-relevance. We divide the BV_{t-1}/E_t into three parts with equal numbers of samples. Dummy variables D_M and D_H indicate the middle and high profit firms group of BV_{t-1}/E_t . Coefficients reported in Table 11 represent the total intercept and slope coefficients for the middle group (i.e., b_1+b_2 for the intercept and b_4+b_5 for the slope) and the total coefficients for the high group (i.e., b_1+b_3 for the intercept and b_4+b_6 for the slope).

The t-statistics in Table 11 indicate that b_5 are insignificantly positive all 20 years, and b_6 are also insignificantly positive in all 20 years. These results suggest that neither lower firms and middle firms groups, nor lower firms and higher firms groups, have significantly different slopes. These results differ from results reported by Burgstahler and Dichev (1997a) and Chen and Zhang (2002).

Insert <Table 11> about here

4.3.3.2.2 Piecewise Linear Regression Analysis Results: Dividing BV_{t-1}/E_t into Profit Firms and Loss Firms Groups

Table 12 shows the division of BV_{t-1}/E_t into profit firms and loss firms groups. Dummy variables D_t indicate the profit firms group of E_t/BV_{t-1} . Coefficients reported in Table 12 represent the total intercept and slope coefficients for the profit firms group (i.e., b_1+b_2 for the intercept and b_4+b_5 for the slope). The t-statistics in Table 12 indicate that b_4 are significantly positive (1%, 5% levels of significance) in 0 of 20 years. These results indicate that loss firms and profit firms groups do not have a slope difference, and suggest that the value-relevance of book value has a linear function shape.

Insert <Table 12> about here

4.3.3.2.3 Piecewise Linear Regression Analysis: Dividing All Data into Earnings Management Firms and Higher Profit Firms Groups

The paper performs a piecewise linear regression by dividing all data into two groups according to the magnitude of earnings/market value of equity (0.00003). This serves as a test of the predicted nonlinear earnings value-relevance because slopes and intercepts of the regression line are able to vary with the magnitude of earnings management. The t-statistics in Table 13 indicate that b_4 are significantly positive (1%, 5% levels of significance) in 9 of 20 years, and in the pooled periods 1982–1991, 1992–2001, and 1982–2001. These results indicate that earnings management firms and higher profit firms groups have significantly different slopes. Therefore market value and book value controlling for earnings must have a nonlinear function. These results are not consistent with results shown in Table 12, which do not distinguish the earnings management group from all sample data. However, these results suggest that earnings management behavior may distort accounting information in the Korean stock market.

Insert <Table 13> about here

In summary, the empirical results do not support H-3, which states that equity value is a linear function of book value, controlling for earnings. This suggests that equity value is a nonlinear function of book value, controlling for earnings, which is consistent with the results of Burgstahler and Dichev (1997a), Zhang (2000), and Chen and Zhang (2002).

5. Conclusions

This study examines whether the accounting earnings and book value have a nonlinear relationship to equity value by using an option-style model of equity from 1982 to 2001 in the Korean stock market. We use an option-style model of equity value to test the hypothesis that earnings and book value have a nonlinear relationship to equity value. The purposes of this study are as follows. First, we use simple linear regression model of equity value and accounting earnings to investigate whether firms listed in the Korean stock market have a linear relationship between equity values and accounting earnings. Second, we use a multiple linear regression model of equity value and accounting earnings/book value to investigate relative value-relevance between accounting earnings and book value. Third, we use a piecewise linear regression model to investigate the nonlinear relationship between equity value and accounting earnings/book value.

The study performs analyses for all samples and across subsamples divided into loss firms and profit firms, observing changes in relationships over a 20-year period. In the third analysis, the paper divides the sample into loss firms, profit firms, and earnings management firms.

The results of this study are as follows. First, the simple regression of equity value and accounting earnings indicates that profit firms have a linear relationship between equity value and accounting earnings, but loss firms do not. These results imply that the value-relevance of accounting earnings differs between loss firms and profit firms. Second, the regression between equity value and accounting earnings/book value indicates that accounting earnings is the most significant variable affecting the equity values of profit firms, while book value affects the equity values of loss firms. These results imply that accounting earnings and book value are acknowledged differently for equity valuation across firms in the Korean stock market, which has a very important implication for Korean investors and CEOs. Third, the results of the piecewise linear regression model between equity value and accounting earnings/book value indicate that equity value is a nonlinear function of accounting earnings for a given book value, and a nonlinear function of book value for given accounting earnings. These results suggest that an option-style valuation model can explain the nonlinear relationship between equity value and accounting earnings/book value.

The important contribution of the study is to show the nonlinear relationship between equity value and book value in the Korean stock market. And the empirical results of the paper reinforces the adoption of a new equity valuation model that explicitly recognized the option that firms have to adapt their resources to the alternative uses available to them.

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Table 1. Sample selection

Total firms firm-year observations from 1982 to 2001	9,086
(-) Firms missing annual data from 1982 to 2001	293
(-) Impairment of capital firms annually from 1982 to 2001	521
(-) Trimming of extreme value (up-and-down 1%)	344
= Total number of analysis data	7,928

Table 2. Descriptive statistics

Year	Number of data	Stock prices per share (P_t)		Earnings per share (E_t/S_t)		Book value per share (BV_{t-1}/S_t)	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
1982	171	5961.32	2095.42	994.49	2920.14	19543.94	23158.55
1983	215	6993.65	3773.14	1712.97	2405.05	13527.72	7926.71
1984	212	8086.66	4942.98	1131.92	3063.16	13908.76	9009.10
1985	222	9736.91	5422.24	880.60	2330.91	15727.81	11952.14
1986	226	19394.25	12080.22	1306.41	3736.09	15493.11	11865.73
1987	247	20007.29	8652.85	1830.38	6482.90	14932.67	12617.24
1988	326	27341.41	6694.17	2094.36	4065.65	13381.66	13232.18
1989	422	23579.60	7358.98	1414.91	3479.11	13253.15	12737.95
1990	452	17187.26	5886.21	1387.03	3671.38	15153.30	13570.42
1991	469	17830.73	16764.48	1210.47	4068.58	15795.72	14583.68
1992	469	17819.04	12485.09	833.30	5113.67	16766.16	17753.58
1993	474	23056.86	25145.65	949.66	3836.02	17507.92	19887.71
1994	493	28481.08	42569.53	1030.11	4898.74	18197.83	23002.06
1995	503	23137.58	39021.89	1004.10	3740.10	19213.97	27159.51
1996	502	28023.81	38642.74	1253.66	3160.31	20199.62	27254.90
1997	556	17695.32	36341.59	-764.94	6294.44	21493.18	30362.44
1998	521	17494.79	39755.67	-3367.31	15260.12	20857.09	23215.48
1999	472	17632.53	38641.32	1159.86	13747.19	24496.48	45545.08
2000	474	12118.66	24935.18	294.63	10833.81	28527.51	58067.02
2001	502	18002.19	40101.41	1893.69	6925.57	25119.96	39737.56
82-91	2962	17166.51	11293.29	1412.19	3856.75	15627.91	22749.48
92-01	4966	21438.29	63373.69	499.61	9232.57	23236.04	104957.29
81-01	7928	19844.40	50688.69	840.11	7692.53	20397.28	84331.51

P_t : Firm stock price 3 months after the end of fiscal year t , where year t is the event year

S_t : Total number of shares outstanding in year t

E_t : Income available to common stockholders in year t

BV_{t-1} : Book value at the end of year t

Table 3. Simple linear regression

Year	Total firms					Profit firms					Loss firms				
	Constant		Coefficient		Adj	Constant		Coefficient		Adj	Constant		Coefficient		Adj
	B ₁	t ₁	b ₂	t ₂	R ²	b ₁	t ₁	b ₂	t ₂	R ²	b ₁	t ₁	b ₂	t ₂	R ²
1982	5977.14	35.20 **	-0.02	-0.29	-0.01	5899.19	23.01 **	0.00	0.05	-0.01	-2693.51	-2.98 **	-0.02	-0.56	-0.02
1983	5664.19	24.92 **	0.98	12.71 **	0.44	5508.58	19.60 **	1.07	11.22 **	0.41	4057.90	9.43 **	0.20	1.37	0.04
1984	7152.27	23.45 **	0.86	9.24 **	0.29	5987.76	15.39 **	1.54	10.44 **	0.37	4277.41	6.17 **	0.11	0.90	-0.01
1985	8730.28	25.70 **	1.14	8.37 **	0.24	7804.07	16.39 **	1.85	7.83 **	0.24	5247.80	6.50 **	0.15	0.86	-0.01
1986	17025.73	24.10 **	1.81	10.14 **	0.31	13490.48	16.55 **	3.63	13.49 **	0.48	10015.99	8.37 **	0.23	1.54	0.05
1987	18539.27	40.45 **	0.80	11.77 **	0.36	18063.77	35.71 **	1.02	11.67 **	0.38	14142.51	15.23 **	0.26	3.74 **	0.39
1988	25574.54	71.27 **	0.84	10.74 **	0.26	25672.52	69.21 **	0.84	10.54 **	0.26	21037.19	9.98 **	-0.89	-1.02	0.00
1989	22370.59	63.09 **	0.86	9.10 **	0.16	22493.60	59.41 **	0.86	8.63 **	0.16	18444.92	13.70 **	-0.35	-0.72	-0.02
1990	16260.86	60.36 **	0.67	9.72 **	0.17	16546.05	57.22 **	0.63	8.68 **	0.15	12331.75	15.87 **	0.03	0.08	-0.03
1991	14286.19	25.12 **	2.94	21.91 **	0.51	13046.14	21.40 **	3.53	23.86 **	0.58	6688.85	8.01 **	-0.23	-1.37	0.02
1992	16224.08	44.69 **	1.91	27.29 **	0.61	15716.90	36.07 **	2.13	25.80 **	0.64	12444.47	24.80 **	0.47	4.47 **	0.17
1993	19763.74	19.52 **	3.47	13.52 **	0.28	19549.71	14.35 **	3.71	11.39 **	0.26	11845.84	14.05 **	0.00	0.00	-0.01
1994	21164.98	18.73 **	7.10	31.43 **	0.67	13774.81	12.85 **	9.08	41.92 **	0.81	15636.74	10.98 **	0.32	1.17 *	0.01
1995	17759.80	11.48 **	5.36	13.39 **	0.26	11016.96	5.70 **	8.02	15.34 **	0.37	11520.18	8.98 **	-0.44	-1.55	0.02
1996	16066.93	13.82 **	9.54	27.87 **	0.61	12987.32	8.97 **	10.24	26.14 **	0.63	-1109.40	-7.44 **	-0.00	-0.35	-0.01
1997	19181.12	13.11 **	1.94	8.41 **	0.11	9401.76	4.00 **	7.14	11.36 **	0.27	8150.17	9.44 **	0.14	1.46	0.01
1998	19554.60	11.22 **	0.61	5.48 **	0.05	11411.37	4.10 **	4.37	8.79 **	0.19	8081.48	11.80 **	0.08	2.88 **	0.04
1999	15824.51	10.64 **	1.56	14.45 **	0.31	10130.42	6.32 **	2.87	20.22 **	0.52	6865.29	6.40 **	0.06	1.09	0.00
2000	11796.75	12.37 **	1.29	14.68 **	0.31	5387.26	6.24 **	3.14	29.71 **	0.72	4682.57	6.53 **	-0.05	-1.03	0.00
2001	10611.65	6.85 **	4.19	20.99 **	0.47	2373.48	1.30	5.76	24.66 **	0.61	6742.20	9.36 **	-0.04	-0.47	-0.01
82-91	15301.10	77.47 **	1.32	27.46 **	0.20	15189.55	67.66 **	1.50	25.92 **	0.20	9894.48	21.35 **	0.17	2.17 *	0.01
92-01	20328.73	23.85 **	2.22	24.08 **	0.11	14274.26	12.65 **	4.43	28.84 **	0.18	9574.03	33.58 **	0.10	4.83 **	0.02
81-01	18068.61	33.29 **	2.11	30.13 **	0.10	13287.39	19.58 **	4.03	36.48 **	0.17	9612.51	39.32 **	0.10	5.33 **	0.02

Simple Regression Equation: $P_t = b_1 + b_2 E_t / S_t + \varepsilon$

P_t : Firm stock price 3 months after the end of fiscal year t, where year t is the event year

S_t : Total number of shares outstanding in year t

E_t : Income available to common stockholders in year t

ε : Error term

*/**: $p < 0.05/0.01$

Table 4. Multiple regression analysis of relative value-relevance of earnings per share and book value per share in profit firms and loss firms

Year	Constant		Coefficient of earnings per share				Coefficient of book value per share				Adj R ²
	Profit firms	Loss firms	Profit firms		Loss firms		Profit firms		Loss firms		
	b ₁ +b ₄	b ₁	b ₂ +b ₅	t ₅	b ₂	t ₂	b ₃ +b ₆	t ₆	b ₃	t ₃	
1982	5812.35	6007.95	0.00	-0.28	0.04	0.38	0.00	-0.67	0.02	0.96	-0.02
1983	4508.04	2700.36	0.98	3.36 **	0.09	0.35	0.09	-0.37	0.12	1.24	0.50
1984	4698.05	1950.07	1.36	5.94 **	0.13	0.92	0.11	-0.93	0.23	1.82	0.45
1985	7121.84	3212.11	1.65	4.39 **	0.15	0.63	0.06	-1.13	0.13	2.84 **	0.35
1986	13428.0	6283.91	3.60	7.79 **	0.15	0.62	0.01	-1.79	0.29	2.07 *	0.52
1987	15544.3	11986.8	0.63	2.37 *	0.24	2.03 *	0.23	0.38	0.18	1.61	0.47
1988	23390.3	16752.5	0.16	1.88	-1.17	-1.67	0.29	0.65	0.24	3.26 **	0.43
1989	21083.7	17682.6	0.39	0.64	-0.08	-0.11	0.17	0.79	0.07	0.63	0.20
1990	14645.1	10197.8	0.10	0.18	0.01	0.02	0.18	0.46	0.14	1.45	0.26
1991	9305.92	3983.80	2.32	4.85 **	0.13	0.34	0.36	0.52	0.28	1.88	0.63
1992	12213.1	10087.8	1.28	3.43 **	0.51	2.66 **	0.28	1.22	0.19	2.50 *	0.71
1993	6959.15	8015.63	1.31	1.74	0.05	0.08	0.90	4.73 **	0.30	2.46 *	0.66
1994	9428.35	10568.4	7.09	10.33 **	0.54	1.09	0.43	0.07	0.42	2.82 **	0.82
1995	1006.39	7852.50	5.52	6.86 **	-0.16	-0.23	0.73	2.93 **	0.27	1.76	0.57
1996	9048.67	6113.96	8.30	3.38 **	-0.48	-0.19	0.35	-0.48	0.44	2.30 *	0.67
1997	-890.29	4004.16	3.23	5.62 **	0.29	1.24	0.77	5.75 **	0.28	3.73 **	0.55
1998	-2685.40	5784.77	1.68	3.48 **	0.10	0.89	0.92	5.04 **	0.16	1.29	0.36
1999	7323.36	5945.53	2.17	8.62	0.07	0.52	0.20	0.84	0.07	0.53	0.54
2000	-744.19	4339.81	2.58	15.43 **	0.07	0.61	0.11	1.27	0.06	1.31	0.75
2001	304.89	3030.70	4.41	9.66 **	0.09	0.26	0.22	-0.79	0.42	1.73	0.58
82-91	15045.4	9488.52	1.46	9.86 **	0.17	1.51	0.02	-0.57	0.03	1.33	0.24
92-01	14405.2	7436.39	5.22	23.65 **	0.19	1.35	-0.09	-3.11 **	0.17	2.13 *	0.20
82-01	13423.4	8003.23	4.55	27.55 **	0.16	1.50	-0.02	-3.42 **	0.12	2.29 *	0.19

Multiple Regression Equation: $P_t = b_1 + b_2 E_t / S_t + b_3 BV_{t-1} / S_t + b_4 D_t + b_5 D_t * E_t / S_t + b_6 D_t * BV_{t-1} / S_t + \varepsilon$

P_t: Firm stock price 3 months after the end of fiscal year t, where year t is the event year

S_t: Total number of shares outstanding in year t

E_t: Income available to common stockholders in year t

BV_{t-1}: Book value at the end of year t

ε: Error term

D_t: Dummy variable (If E_t ≥ 0 D=1, Or, D=0)

*/** : p < 0.05/0.01

Table 5. Descriptive statistics of all samples controlling for book value and earnings

Year	Sample number	Controlling for book value				Sample number	Controlling for earnings			
		E_t/BV_{t-1}		V_t/BV_{t-1}			BV_{t-1}/E_t		V_t/E_t	
		Means	Standard deviation	Means	Standard deviation		Means	Standard deviation	Means	Standard deviation
1982	160	0.13	0.24	0.80	1.17	132	37.07	95.35	12.05	47.10
1983	195	0.13	0.17	0.65	0.40	177	23.38	62.63	10.54	25.42
1984	207	0.09	0.18	0.71	0.50	180	20.19	37.42	10.27	15.14
1985	215	0.06	0.15	0.83	0.62	189	22.30	34.10	22.30	34.10
1986	218	0.10	0.12	1.65	1.46	199	22.22	64.62	20.55	25.79
1987	241	0.14	0.17	1.92	1.44	224	13.92	19.49	22.08	33.93
1988	322	0.17	0.16	3.16	1.99	307	11.76	18.02	33.43	57.65
1989	418	0.12	0.14	2.62	1.73	391	17.46	34.05	36.95	66.00
1990	446	0.09	0.13	1.52	1.54	414	25.07	56.52	34.25	76.18
1991	464	0.06	0.16	1.19	0.79	411	22.28	28.95	20.17	19.03
1992	456	0.03	0.16	1.33	1.10	372	31.37	60.18	36.59	66.20
1993	461	0.03	0.16	1.48	0.82	364	29.36	50.78	39.32	63.69
1994	482	0.04	0.17	1.75	1.20	467	27.97	44.06	39.18	59.87
1995	493	0.04	0.18	1.37	1.03	403	27.00	46.47	31.71	55.01
1996	537	0.01	0.20	1.89	5.17	407	30.40	49.36	38.34	57.50
1997	522	-0.02	0.24	0.94	1.66	352	41.14	69.17	24.84	36.65
1998	442	-0.00	0.27	1.00	0.83	322	31.92	53.96	25.66	45.02
1999	442	0.06	0.21	1.21	2.01	371	19.06	28.28	17.57	42.99
2000	442	0.03	0.21	0.61	0.75	344	33.06	59.87	14.30	30.86
2001	476	0.04	0.21	1.20	3.05	379	22.16	42.78	16.16	32.56
82-91	2886	0.11	0.16	1.65	1.57	2624	20.73	46.05	24.58	49.66
92-01	4753	0.03	0.20	1.29	2.30	3723	29.18	51.52	28.70	51.80
82-01	7639	0.06	0.19	1.42	2.06	6345	25.69	49.51	27.01	50.97

V_t : Number of shares outstanding at the end of year t times the stock price per share 3 months after the end of fiscal year t

BV_{t-1} : Book value at the end of year t

E_t : Income available to common stockholders in year t

E_t/BV_{t-1} : Book value of equity at the end of year t-1/Earnings in period t

V_t/BV_{t-1} : Market value of equity at the end of year t/Book value of equity at the end of year t-1

BV_{t-1}/E_t : Book value of equity at the end of year t-1/Earnings in period t

V_t/E_t : Market value of equity at the end of year t/Earnings in period t

Table 6. Value relevance of earnings after controlling for book value

Year	Constant b_1 (t_1)			Coefficient b_2 (t_2)			Adj. R^2
1982	0.51	5.53	**	2.28	6.76	**	0.22
1983	0.53	15.69	**	0.91	5.71	**	0.14
1984	0.62	17.26	**	1.00	5.61	**	0.13
1985	0.75	17.17	**	1.23	4.53	**	0.08
1986	1.26	10.21	**	3.77	4.89	**	0.10
1987	1.54	13.89	**	2.82	5.64	**	0.11
1988	2.43	16.27	**	4.34	6.88	**	0.13
1989	2.08	20.08	**	4.60	8.15	**	0.14
1990	1.19	14.42	**	3.76	7.14	**	0.10
1991	1.07	30.03	**	2.07	10.23	**	0.18
1992	1.29	24.96	**	1.35	4.38	**	0.04
1993	1.44	38.47	**	1.27	5.42	**	0.06
1994	1.69	30.37	**	1.36	4.22	**	0.03
1995	1.32	28.37	**	1.04	4.23	**	0.03
1996	1.87	8.35	**	1.84	1.65		0.00
1997	0.97	13.44	**	1.21	4.10	**	0.03
1998	1.00	27.57	**	1.22	8.99	**	0.15
1999	1.06	10.98	**	2.14	4.79	**	0.05
2000	0.59	16.80	**	0.92	5.42	**	0.06
2001	1.24	8.67	**	-0.75	-1.14	**	0.00
82-91	1.30	39.79	**	3.28	19.58	**	0.12
92-01	1.26	37.56	**	1.18	7.25	**	0.01
82-01	1.32	54.50	**	1.87	15.63	**	0.03

Simple regression equation: $V_t/BV_{t-1} = b_1 + b_2 E_t/BV_{t-1} + \varepsilon$

Variable definitions: See <Table 5>

ε : Error term

*/**: $p < 0.05/0.01$

Table 7. Market value as a piecewise function of earnings controlling for book value (three equal groups)

Year	Cutoff Point (E/BV)					Constants						Coefficients						Adj. R ²
	Lower (%)	Cut-off	Mid (%)	Cut-off	Higher (%)	Lower firms b ₁ (t ₁)		Middle firms b ₁ +b ₂ (t ₂)		Higher firms b ₁ +b ₃ (t ₃)		Lower firms b ₄ (t ₄)		Middle firms b ₄ +b ₅ (t ₅)		Higher firms b ₄ +b ₆ (t ₆)		
1982	33.3	0.03	33.3	0.15	33.3	0.36	2.38 *	-0.08	-1.16	0.26	-0.30	-0.96	-1.06	7.08	1.93	3.25	3.76 **	0.29
1983	33.3	0.06	33.3	0.17	33.3	0.44	10.19 **	0.38	-0.31	0.63	1.46	-0.46	-1.69	1.77	1.55	1.01	2.98 **	0.27
1984	33.3	0.05	33.3	0.13	33.3	0.45	7.82 **	0.58	0.54	0.71	1.83	-0.20	-0.67	0.96	0.48	1.21	2.55 *	0.21
1985	33.3	0.04	33.3	0.10	33.3	0.54	7.86 **	0.87	1.13	0.70	0.93	-0.09	-0.23	-0.54	-0.12	2.35	2.64 **	0.16
1986	33.3	0.06	33.3	0.14	33.3	0.98	6.57 **	1.50	0.73	0.36	-1.15	-2.49	-2.04 *	0.24	0.39	9.63	4.67 **	0.23
1987	33.3	0.08	33.3	0.16	33.3	1.53	10.51 **	0.52	-1.34	0.89	-1.71	-0.20	-0.22	10.26	1.72	5.39	3.98 **	0.17
1988	33.3	0.10	33.3	0.20	33.3	2.69	14.87 **	1.43	-1.38	1.56	-2.27 *	-1.10	-0.69	9.86	1.74	7.18	4.08 **	0.17
1989	33.3	0.06	33.3	0.15	33.3	2.00	15.08 **	1.63	-0.58	2.03	0.11	-1.32	-1.01	8.02	1.54	5.61	4.15 **	0.18
1990	33.3	0.05	33.3	0.10	33.3	1.26	10.84 **	1.40	0.25	0.31	-4.06 **	0.05	0.04	1.23	0.17	7.67	5.61 **	0.16
1991	33.3	0.04	33.3	0.10	33.3	0.71	13.48 **	0.70	-0.03	1.16	4.24 **	-0.50	-1.82	5.74	2.17 *	3.24	7.68 **	0.39
1992	33.3	0.03	33.3	0.07	33.3	1.03	10.78 **	1.38	1.07	1.05	0.08	-0.27	-0.61	-2.24	-0.32	4.00	4.55 **	0.09
1993	33.3	0.02	33.3	0.07	33.3	1.10	15.73 **	1.37	1.21	1.35	1.75	-0.49	-1.54	0.60	0.24	3.58	4.87 **	0.17
1994	33.3	0.03	33.3	0.08	33.3	1.25	13.64 **	1.00	-0.76	1.25	0.03	-1.81	-4.29 **	8.93	1.99 *	6.36	8.78 **	0.24
1995	33.3	0.03	33.3	0.08	33.3	0.98	11.66 **	0.84	-0.48	1.30	2.25 *	-1.16	-3.09 **	7.52	1.73	2.61	6.04 **	0.14
1996	33.3	0.02	33.3	0.06	33.3	1.54	3.39 **	0.69	-0.63	1.16	-0.49	-1.04	-0.64	13.49	0.47	10.14	3.09 **	0.03
1997	33.3	0.00	33.3	0.06	33.3	0.60	3.45 **	0.37	-0.78	1.28	2.62 **	-0.01	-0.01	11.49	1.47	1.65	1.57	0.07
1998	33.3	0.01	33.3	0.08	33.3	0.79	9.39 **	0.56	-1.32	1.14	2.54 *	0.49	2.22 *	7.15	1.99 *	1.62	2.40 *	0.22
1999	33.3	0.04	33.3	0.12	33.3	0.91	5.09 **	0.87	-0.08	0.47	-1.12	0.41	0.59	-0.17	-0.08	6.26	3.84 **	0.10
2000	33.3	0.02	33.3	0.08	33.3	0.50	7.32 **	0.25	-1.46	0.30	-1.56	0.10	0.40	4.53	1.46	3.17	5.63 **	0.15
2001	33.3	0.03	33.3	0.12	33.3	0.77	2.71 **	0.91	0.16	0.82	0.08	-3.33	-3.24 **	-1.99	0.13	3.52	2.97 **	0.03
82-91	33.3	0.06	33.3	0.13	33.3	1.08	23.03 **	1.20	0.57	1.20	1.06	-0.16	-0.52	3.40	1.68	4.54	10.20 **	0.16
92-01	33.3	0.02	33.3	0.08	33.3	0.93	13.62 **	0.86	-0.37	1.04	0.92	-0.51	-2.09 *	5.05	1.66	3.87	8.23 **	0.03
82-01	33.3	0.04	33.3	0.10	33.3	0.96	22.43 **	0.92	-0.25	1.10	1.64	-0.46	-2.49 *	5.25	2.78 **	4.28	13.17 **	0.07

Multiple regression equation: $V_t/BV_{t-1} = b_1 + b_2D_M + b_3D_H + b_4E_t/BV_{t-1} + b_5D_ME_t/BV_{t-1} + b_6D_HE_t/BV_{t-1} + \epsilon$

Variable definitions: See <Table 5>

ϵ : Error term

*/**: $p < 0.05/0.01$

D_M and D_H are dummy variables for the middle and higher firms group defined by the E_t/BV_{t-1} cutoffs.

Table 8. Market value as a piecewise function of earnings controlling for book value (two equal profit groups and one loss group)

Year	Cutoff Point (E/BV)					Constants						Coefficients						Adj. R ²					
year	Loss (%)	Cut-off	Lower (%)	Cut-off	Higher (%)	Loss firms b ₁ (t ₁)		Lower profit firms b ₁ +b ₂ (t ₂)		Higher profit firms b ₁ +b ₃ (t ₃)		Loss firms b ₄ (t ₄)		Lower profit firms b ₄ +b ₅ (t ₅)		Higher profit firms b ₄ +b ₆ (t ₆)		Adj. R ²					
1982	18	0	41	0.12	41	0.39	1.52	0.24	-0.44	0.35	-0.13	-0.88	-0.78	2.25	0.84	3.10	3.16	**	0.29				
1983	9	0	45	0.13	46	0.44	4.59	**	0.37	-0.53	0.54	0.79	-0.46	-1.41	1.60	1.94	1.24	3.63	**	0.27			
1984	13	0	43	0.11	44	0.48	3.55	**	0.33	-0.90	0.58	0.60	-0.14	-0.32	4.17	2.73	**	1.58	2.89	**	0.21		
1985	17	0	41	0.08	42	0.50	3.37	**	0.39	-0.55	0.55	0.29	-0.17	-0.36	7.72	2.82	**	2.97	3.57	**	0.16		
1986	9	0	45	0.11	46	0.61	1.77	0.57	-0.09	0.34	-0.53	-3.78	-2.50	*	10.88	3.09	**	9.67	5.71	**	0.24		
1987	7	0	46	0.13	47	1.73	4.18	**	1.30	-0.84	1.10	-1.28	0.16	0.12	3.20	0.78	4.90	3.04	**	0.16			
1988	5	0	47	0.14	48	1.99	3.39	**	2.57	0.84	1.84	-0.22	-3.17	-1.39	1.24	0.99	6.54	3.87	**	0.17			
1989	6	0	47	0.11	47	1.02	2.58	*	1.80	1.65	1.91	1.98	*	-4.96	-2.67	**	6.50	2.56	*	5.95	5.28	**	0.19
1990	7	0	46	0.08	47	0.90	2.72	**	1.20	0.77	0.55	-0.94	-1.11	-0.78	4.37	1.16	7.01	4.99	**	0.16			
1991	9	0	45	0.08	46	0.44	3.60	**	0.60	1.02	1.05	4.28	**	-1.14	-3.07	**	7.44	3.74	**	3.57	8.99	**	0.39
1992	18	0	41	0.06	41	0.95	6.16	**	1.06	0.47	1.00	0.20	-0.46	-0.86	4.76	1.17	4.19	4.93	**	0.09			
1993	21	0	39	0.06	40	0.93	9.14	**	1.26	2.00	*	1.31	2.52	*	-0.92	-2.47	*	2.52	0.99	3.77	5.83	**	0.18
1994	15	0	42	0.08	43	1.00	5.83	**	1.22	0.99	1.25	1.14	-2.39	-4.46	**	4.69	2.01	*	6.36	9.17	**	0.24	
1995	18	0	41	0.06	41	0.68	4.99	**	1.00	1.53	1.27	3.45	**	-1.86	-4.15	**	4.90	1.69	2.70	6.99	**	0.15	
1996	24	0	38	0.06	38	1.81	3.04	**	0.94	-0.83	1.09	-0.87	-0.48	-0.27	7.68	0.31	10.37	3.02	**	0.03			
1997	33	0	33	0.06	34	0.61	3.44	**	0.36	-0.87	1.27	2.50	*	0.03	0.07	11.67	1.50	1.67	1.55	0.07			
1998	27	0	36	0.07	37	0.81	7.67	**	0.65	-1.06	1.11	2.01	*	0.53	2.13	*	5.12	1.49	1.71	2.49	*	0.22	
1999	16	0	42	0.10	42	0.94	2.75	**	0.95	0.01	0.32	-1.38	0.47	0.52	-1.42	-0.35	6.69	4.04	**	0.09			
2000	22	0	39	0.07	39	0.60	6.31	**	0.41	-1.37	0.38	-1.61	0.31	1.09	-0.20	-0.19	2.90	4.83	**	0.15			
2001	37	0	31	0.10	32	0.91	1.99	*	0.61	-0.46	0.60	-0.48	-3.05	-2.38	*	2.58	0.69	4.16	3.11	**	0.03		
82-91	9	0	45	0.10	46	0.80	6.80	**	0.88	0.58	1.10	2.20	*	-0.97	-2.32	*	7.70	5.75	**	4.78	11.18	**	0.17
92-01	22	0	39	0.07	39	0.97	9.75	**	0.81	-1.07	1.02	0.33	-0.43	-1.48	6.13	2.30	*	3.95	8.23	**	0.03		
82-01	17	0	41	0.08	42	0.93	12.11	**	0.82	-1.01	1.06	1.30	-0.53	-2.27	*	6.89	4.55	**	4.40	13.47	**	0.07	

Multiple regression equation: $V_t/BV_{t-1} = b_1 + b_2D_M + b_3D_H + b_4E_t/BV_{t-1} + b_5D_ME_t/BV_{t-1} + b_6D_HE_t/BV_{t-1} + \epsilon$

Variable definitions: See <Table 5>

ϵ : Error term

*/**: $p < 0.05/0.01$

D_M and D_H are dummy variables for the lower profit and higher profit firms group defined by the E_t/BV_{t-1} cutoffs.

Table 9. Market value as a piecewise function of earnings controlling for book value (dividing data into three equal groups according to the magnitude of earnings/market value)

Year	Cutoff Point (E/BV)					Constants						Coefficients						Adj. R ²
year	Loss (%)	Cut-off	Lower (%)	Cut-off	Higher (%)	Loss firms b ₁ (t ₁)		Earnings management b ₁ +b ₂ (t ₂)		Higher profit firms b ₁ +b ₃ (t ₃)		Loss firms b ₄ (t ₄)		Earnings management b ₄ +b ₅ (t ₅)		Higher profit firms b ₄ +b ₆ (t ₆)		Adj. R ²
1982	17	0	3	0.0000	80	0.39	1.55	0.29	-0.15	0.19	-0.74	-0.88	-0.80	117.2	2.03 *	3.42	3.68 **	0.32
1983	9	0	5	0.0000	86	0.44	4.56 **	0.40	-0.20	0.38	-0.49	-0.46	-1.40	11.41	0.75	1.74	5.60 **	0.26
1984	13	0	2	0.0000	85	0.48	3.52 **	0.43	-0.14	0.48	-0.01	-0.14	-0.32	-8.67	-0.21	1.95	3.98 **	0.20
1985	12	0	6	0.0000	82	0.50	3.54 **	0.57	0.30	0.50	0.01	-0.17	-0.38	27.39	3.94 **	3.32	5.15 **	0.24
1986	8	0	10	0.0000	81	0.61	2.49 *	0.29	-0.94	0.67	0.23	-3.78	-3.53 **	40.16	15.93 **	7.02	8.00 **	0.62
1987	7	0	11	0.0000	82	1.73	4.65 **	0.95	-1.56	0.91	-2.05 *	0.16	0.14	33.55	6.06 **	5.32	3.97 **	0.32
1988	5	0	20	0.0000	75	1.99	3.85 **	2.11	0.19	1.31	-1.24	-3.17	-1.58	26.49	6.37 **	7.79	5.14 **	0.35
1989	6	0	27	0.0000	66	1.02	3.20 **	1.13	0.31	1.18	0.46	-4.96	-3.30 **	35.63	12.99 **	7.71	7.82 **	0.47
1990	7	0	21	0.0000	72	0.90	6.13 **	0.68	-1.31	1.22	2.08 *	-1.11	-1.76	34.32	36.34 **	1.58	3.76 **	0.83
1991	11	0	11	0.0000	78	0.44	3.65 **	0.22	-1.06	0.77	2.60 **	-1.14	-3.11 **	40.21	5.88 **	4.60	12.09 **	0.41
1992	18	0	23	0.0000	58	0.95	8.10 **	0.05	-5.43 **	0.82	-0.98	-0.46	-1.13	60.50	17.72 **	4.40	7.34 **	0.47
1993	21	0	25	0.0000	54	0.93	10.88 **	0.49	-3.30 **	0.99	0.56	-0.92	-2.94 **	41.29	13.78 **	5.04	9.93 **	0.42
1994	15	0	25	0.0000	60	1.00	6.27 **	0.83	-0.75	0.88	-0.62	-2.39	-4.79 **	30.97	8.81 **	7.68	12.88 **	0.35
1995	18	0	19	0.0000	63	0.68	5.69 **	0.69	0.04	0.97	2.14 *	-1.86	-4.73 **	33.65	12.47 **	3.35	9.60 **	0.35
1996	24	0	23	0.0000	53	1.81	3.25 **	-0.07	-2.40 *	0.54	-1.86	-0.48	-0.29	72.30	8.66 **	8.48	2.88 **	0.14
1997	33	0	14	0.0000	54	0.61	3.70 **	0.30	-1.12	0.57	-0.21	0.03	0.07	47.89	9.23 **	3.65	4.22 **	0.20
1998	27	0	12	0.0000	61	0.81	8.97 **	0.49	-2.27 *	0.70	-1.05	0.53	2.49 *	38.07	12.49 **	2.82	6.52 **	0.43
1999	16	0	7	0.0000	77	0.94	4.04 **	1.11	0.42	0.11	-3.24 **	0.47	0.76	57.18	15.75 **	6.33	6.64 **	0.58
2000	22	0	5	0.0000	73	0.60	6.80 **	0.56	-0.23	0.24	-3.54 **	0.31	1.17	31.55	6.58 **	3.36	7.27 **	0.27
2001	20	0	8	0.0000	72	0.91	2.07 *	0.24	-0.88	0.26	-1.28	-3.05	-2.48 *	57.06	5.49 **	4.96	4.26 **	0.10
82-91	9	0	14	0.0000	77	0.80	8.41 **	0.84	0.37	0.77	-0.22	-0.97	-2.86 **	36.16	35.53 **	5.28	16.05 **	0.46
92-01	22	0	16	0.0000	62	0.97	10.59 **	0.18	-5.88 **	0.63	-3.20 **	-0.43	-1.61	57.56	27.53 **	4.66	11.68 **	0.18
82-01	17	0	16	0.0000	68	0.93	13.36 **	0.53	-4.20 **	0.67	-3.28 **	-0.53	-2.50 *	44.97	38.58 **	5.09	18.96 **	0.24

Multiple regression equation: $V_t/BV_{t-1} = b_1 + b_2D_M + b_3D_H + b_4E_t/BV_{t-1} + b_5D_ME_t/BV_{t-1} + b_6D_HE_t/BV_{t-1} + \epsilon$

Variable definitions: See <Table 5>

ϵ : Error term

*/**: $p < 0.05/0.01$

D_M and D_H are dummy variables for the earnings management and higher profit firms group defined by the E_t/BV_{t-1} cutoffs.

Table 10. Value relevance of book value after controlling for earnings

Year	Constant b_1 (t_1)			Coefficient b_2 (t_2)			Adj. R^2
1982	1.77	0.48		0.28	7.73	**	0.31
1983	2.44	2.29	*	0.35	21.62	**	0.73
1984	2.76	5.47	**	0.37	31.30	**	0.85
1985	0.57	0.52		0.68	25.23	**	0.77
1986	13.01	12.74	**	0.34	22.64	**	0.72
1987	4.00	2.15	*	1.30	16.68	**	0.55
1988	-0.52	-0.31		2.89	36.51	**	0.81
1989	11.58	4.66	**	1.45	22.33	**	0.56
1990	2.59	1.81		1.26	54.55	**	0.88
1991	8.39	11.89	**	0.53	27.36	**	0.65
1992	9.13	3.89	**	0.88	25.26	**	0.63
1993	7.28	3.82	**	1.09	33.57	**	0.76
1994	8.21	4.03	**	1.12	28.35	**	0.66
1995	6.02	3.19	*	0.95	27.05	**	0.65
1996	9.85	4.95	**	0.94	27.28	**	0.65
1997	10.92	6.23	**	0.34	15.53	**	0.41
1998	5.22	2.79	**	0.64	21.42	**	0.59
1999	6.76	2.70	**	0.57	7.72	**	0.14
2000	2.76	1.97	*	0.35	17.00	**	0.46
2001	3.92	3.02	**	0.55	20.46	**	0.53
82-91	9.91	12.35	**	0.71	44.52	**	0.43
92-01	7.99	11.56	**	0.71	60.82	**	0.50
82-01	8.83	16.87	**	0.71	75.36	**	0.47

Simple regression equation: $V_t/E_t = b_1 + b_2 BV_{t-1}/E_t + \varepsilon$

Variable definitions: See <Table 5>

ε : Error term

*/**: $p < 0.05/0.01$

Table 11. Market value as a piecewise function of book value controlling for earnings (three equal groups)

Year	Cutoff Point (E/BV)					Constants						Coefficients						Adj. R ²
year	Lower (%)	Cut-off	Middle (%)	Cut-off	Higher (%)	Lower profit firms b ₁ (t ₁)		Middle profit firms		Higher profit firms b ₁ +b ₃ (t ₃)		Lower profit firms b ₄ (t ₄)		Middle profit firms b ₄ +b ₅ (t ₅)		Higher profit firms		Adj. R ²
1982	33.3	5.35	33.3	17.2	33.3	2.96	0.5	7.11	0.21	-1.55	0.48	0.29	7.04	0.29	-	-0.14	-0.25	0.30
1983	33.3	5.41	33.3	11.6	33.3	2.16	1.25	1.24	-0.11	3.30	0.43	0.34	19.45	0.34	-	0.45	0.11	0.72
1984	33.3	6.79	33.3	13.5	33.3	0.62	0.24	2.45	0.39	2.53	0.68	0.87	1.49	0.42	-0.64	0.37	-0.85	0.84
1985	33.3	8.70	33.3	18.5	33.3	3.92	0.66	-4.1	-0.83	-6.52	-1.64	0.45	0.46	1.19	0.66	0.74	0.30	0.79
1986	33.3	6.65	33.3	13.3	33.3	7.44	1.07	-0.7	-0.77	18.52	1.55	0.84	0.60	1.64	0.49	0.32	-0.37	0.74
1987	33.3	5.91	33.3	11.0	33.3	3.52	0.41	11.8	0.49	4.74	0.13	1.41	0.67	0.31	-0.40	1.29	-0.06	0.55
1988	33.3	4.90	33.3	9.49	33.3	7.86	0.95	13.3	0.35	-7.35	-1.70	1.27	0.53	0.99	-0.09	3.01	0.72	0.82
1989	33.3	6.72	33.3	13.4	33.3	6.87	0.55	6.79	-0.00	19.54	0.95	1.74	0.66	1.74	0.00	1.39	-0.13	0.56
1990	33.3	9.40	33.3	17.9	33.3	3.58	0.48	0.53	-0.21	2.14	-0.18	0.99	0.84	1.50	0.34	1.26	0.23	0.88
1991	33.3	9.50	33.3	20.4	33.3	3.75	1.31	4.04	0.06	11.62	2.43	1.11	2.50	0.82	-0.53	0.49	-1.39	0.65
1992	33.3	11.76	33.3	23.9	33.3	3.44	0.35	10.8	0.36	19.80	1.50	1.11	0.89	0.59	-0.32	0.83	-0.23	0.64
1993	33.3	11.46	33.3	23.7	33.3	3.90	0.44	4.92	0.06	13.20	0.98	1.32	1.15	1.11	-0.15	1.06	-0.23	0.76
1994	33.3	10.75	33.3	23.0	33.3	4.84	0.57	7.11	0.14	11.36	0.69	1.55	1.29	1.09	-0.31	1.09	-0.39	0.66
1995	33.3	10.49	33.3	22.6	33.3	4.81	0.60	7.07	0.14	8.99	0.47	0.95	0.83	0.84	-0.07	0.93	-0.02	0.64
1996	33.3	11.75	33.3	27.2	33.3	11.28	1.34	15.1	0.25	8.63	-0.28	1.05	0.92	0.56	-0.37	0.95	-0.09	0.64
1997	33.3	10.37	33.3	33.4	33.3	4.74	0.69	14.7	0.93	13.72	1.15	0.71	0.70	0.28	-0.39	0.32	-0.38	0.41
1998	33.3	8.97	33.3	23.5	33.3	1.54	0.22	0.96	-0.04	5.20	0.45	1.25	0.94	0.98	-0.18	0.64	-0.46	0.58
1999	33.3	7.36	33.3	15.0	33.3	7.09	0.62	11.1	0.19	15.17	0.64	0.24	0.10	-0.16	-0.14	0.47	0.10	0.14
2000	33.3	9.73	33.3	22.7	33.3	3.60	0.61	4.80	0.11	2.89	-0.11	0.23	0.24	0.20	-0.02	0.35	0.13	0.45
2001	33.3	7.43	33.3	15.7	33.3	2.91	0.44	15.3	1.06	4.51	0.23	0.84	0.67	-0.60	-0.93	0.55	-0.23	0.52
82-91	33.3	6.94	33.3	14.8	33.3	4.26	1.08	5.08	0.11	16.05	2.80	1.24	1.49	1.06	-0.17	0.67	-0.68	0.44
92-01	33.3	9.78	33.3	22.4	33.3	4.36	1.48	6.04	0.31	12.91	2.63	0.98	2.11	0.78	-0.36	0.68	-0.64	0.50
82-01	33.3	8.43	33.3	18.9	33.3	4.07	1.72	5.06	0.23	13.82	3.78	1.17	2.73	0.94	-0.46	0.68	-1.15	0.48

Multiple regression equation: V_t/E_t

$$= b_1 + b_2 D_M + b_3 D_H + b_4 BV_{t-1}/E_t + b_5 D_M BV_{t-1}/E_t + b_6 D_H BV_{t-1}/E_t + \varepsilon$$

Variable definitions: See <Table 5>

ε : Error term

*/**: $p < 0.05/0.01$

D_M and D_H are dummy variables for the middle and higher firms group defined by the BV_{t-1}/E_t cutoffs.

Table 12. Market value as a piecewise function of book value controlling for earnings (profit firms group and loss firms group)

Year	Cutoff ratio (%)		Constants				Coefficients				Adj. R ²
	Loss	Earnings	Loss firms b ₁ (t ₁)		Profit firms b ₁ +b ₂ (t ₂)		Loss firms b ₃ (t ₃)		Profit firms b ₃ +b ₄ (t ₄)		
1982	50	50	3.32	0.34	-0.24	-0.32	0.27	0.14	0.28	0.01	0.30
1983	50	50	1.30	0.31	2.81	0.34	0.53	0.63	0.34	-0.22	0.72
1984	50	50	2.28	1.33	2.89	0.32	0.44	1.55	0.37	-0.25	0.84
1985	50	50	4.84	1.26	-1.54	-1.52	0.28	0.58	0.70	0.87	0.77
1986	50	50	9.21	2.08 *	16.94	1.66	0.42	0.58	0.32	-0.13	0.74
1987	50	50	3.89	0.64	3.88	-0.00	1.34	1.13	1.30	-0.03	0.55
1988	50	50	5.24	0.89	-5.07	-1.60	2.19	1.63	2.97	0.59	0.82
1989	50	50	7.49	0.82	15.86	0.85	1.61	1.07	1.42	-0.13	0.56
1990	50	50	2.00	0.37	2.96	0.17	1.30	1.95	1.26	-0.06	0.88
1991	50	50	5.55	2.59 **	10.41	2.01 *	0.76	2.97 **	0.50	-1.00	0.65
1992	50	50	4.54	0.59	14.34	1.15	0.96	1.29	0.85	-0.15	0.63
1993	50	50	4.94	0.78	9.68	0.68	1.17	1.87	1.08	-0.15	0.76
1994	50	50	7.02	1.10	9.52	0.35	1.15	1.69	1.10	-0.08	0.66
1995	50	50	4.09	0.70	7.58	0.53	1.05	1.70	0.94	-0.18	0.64
1996	50	50	13.68	2.40 *	7.94	-0.88	0.66	1.21	0.95	0.53	0.65
1997	50	50	2.07	0.37	13.18	1.80	1.27	1.84	0.33	-1.37	0.41
1998	50	50	3.05	0.63	6.03	0.52	0.88	1.47	0.63	-0.41	0.59
1999	50	50	7.14	0.88	9.29	0.24	0.25	0.20	0.54	0.23	0.13
2000	50	50	2.18	0.51	2.15	-0.01	0.48	0.95	0.35	-0.25	0.45
2001	50	50	4.80	1.00	3.09	-0.33	0.51	0.70	0.56	0.07	0.52
82-91	50	50	5.11	1.82	13.57	2.78 **	1.05	2.32 *	0.68	-0.80	0.43
92-01	50	50	4.85	2.28 *	10.66	2.44 *	0.88	3.59 **	0.69	-0.77	0.50
82-01	50	50	4.87	2.88 **	11.74	3.67 **	0.98	4.34 **	0.69	-1.30	0.47

Multiple regression equation: $V_t/E_{t-1} = b_1 + b_2D_t + b_3BV_{t-1}/E_t + b_4D_tBV_{t-1}/E_t + \varepsilon$

Variable definitions: See <Table 5>

ε : Error term

*/**: $p < 0.05/0.01$

D_t represents dummy variables for the profit firms group defined by the BV_{t-1}/E_t cutoffs.

Table 13. Market value as a piecewise function of book value controlling for earnings, dividing all data into two groups according to the magnitude of earnings/market value (0.00003)

Year	Group ratio (%)		Constants				Coefficients				Adj. R ²
	Earnings management	Higher profit firms	Earnings management firms b ₁ (t ₁)		Higher profit firms b ₁ +b ₂ (t ₂)		Earnings management firms b ₃ (t ₃)		Higher profit firms b ₃ +b ₄ (t ₄)		
1982	3.0	97.0	124.63	4.98 **	5.16	-4.74 **	0.23	4.07 **	0.03	-2.79 **	0.57
1983	5.1	94.9	30.15	4.40 **	3.21	-3.87 **	0.28	11.39 **	0.23	-0.77	0.75
1984	3.3	96.7	5.51	0.95	3.75	-0.30	0.37	13.01 **	0.30	-1.84	0.85
1985	7.4	92.6	19.11	4.62 **	6.07	-3.03 **	0.65	20.17 **	0.27	-6.05 **	0.85
1986	12.6	87.4	39.98	15.84 **	9.23	-10.72 **	0.27	20.05 **	0.43	1.56	0.83
1987	13.8	86.2	30.88	5.04 **	7.31	-3.55 **	1.03	9.73 **	0.66	-1.47	0.61
1988	23.1	76.9	9.75	2.62 **	10.71	0.21	2.84	32.24 **	0.78	-6.39 **	0.84
1989	30.7	69.3	32.99	7.12 **	11.05	-3.30 **	1.32	19.13 **	0.67	-1.37	0.59
1990	23.9	76.1	15.45	5.22 **	9.32	-1.64	1.23	51.32 **	0.45	-5.29 **	0.89
1991	13.1	86.9	30.17	13.79 **	9.03	-9.00 **	0.37	14.95 **	0.38	0.08	0.73
1992	29.3	70.7	29.46	6.39 **	9.08	-3.29 **	0.80	21.14 **	0.45	-1.44	0.66
1993	32.7	67.3	20.07	5.58 **	9.62	-2.01 *	1.03	28.62 **	0.58	-1.82	0.77
1994	30.7	69.3	23.57	5.76 **	11.32	-2.24 *	1.02	22.77 **	0.53	-2.09 *	0.68
1995	24.8	75.2	23.92	5.84 **	8.52	-2.94 **	0.87	22.03 **	0.48	-1.98 *	0.67
1996	30.7	69.3	38.36	11.34 **	11.61	-5.91 **	0.82	24.22 **	0.27	-3.74 **	0.73
1997	20.7	79.3	46.52	12.38 **	9.29	-8.85 **	0.24	10.26 **	0.13	-1.91	0.57
1998	18.6	81.4	33.59	6.39 **	6.93	-4.58 **	0.52	13.57 **	0.30	-1.69	0.63
1999	8.9	91.1	89.81	11.81 **	6.50	-10.52 **	0.32	3.29 **	0.15	-1.28	0.44
2000	7.0	93.0	51.63	10.04 **	5.69	-8.72 **	0.31	12.22 **	0.10	-6.00 **	0.69
2001	10.3	89.7	43.93	11.34 **	6.06	-9.27 **	0.44	15.29 **	0.17	-4.37 **	0.68
82-91	16.5	83.5	42.82	22.51 **	11.65	-14.95 **	0.67	39.70 **	0.10	-13.87 **	0.55
92-01	21.7	78.3	38.59	26.01 **	10.57	-16.68 **	0.63	50.07 **	0.14	-14.93 **	0.60
82-01	19.5	80.5	40.07	34.23 **	11.07	-22.20 **	0.64	63.72 **	0.12	-20.34 **	0.58

Multiple regression equation: $V_t/E_{t-1} = b_1 + b_2 D_t + b_3 BV_{t-1}/E_t + b_4 D_t BV_{t-1}/E_t + \varepsilon$

Variable definitions: See <Table 5>

ε : Error term

*/**: $p < 0.05$ 0.01

D_t is the dummy variable for the higher profit firms group defined by the BV_{t-1}/E_t cutoffs.

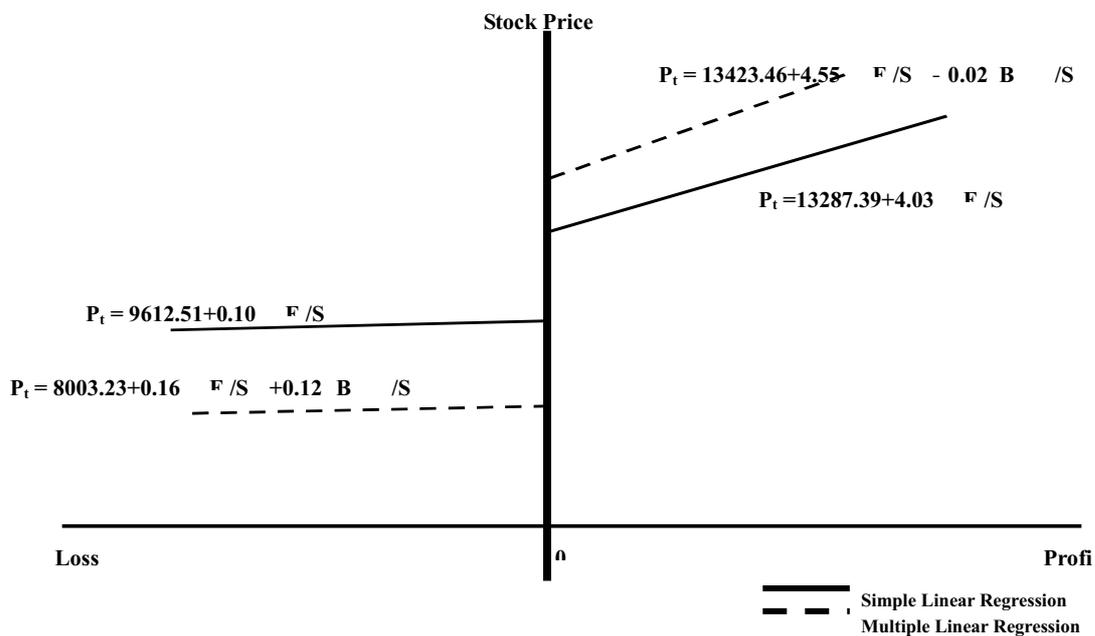


Figure 1. Relative value-relevance of earnings per share and book value per share in profit firms and loss firms.

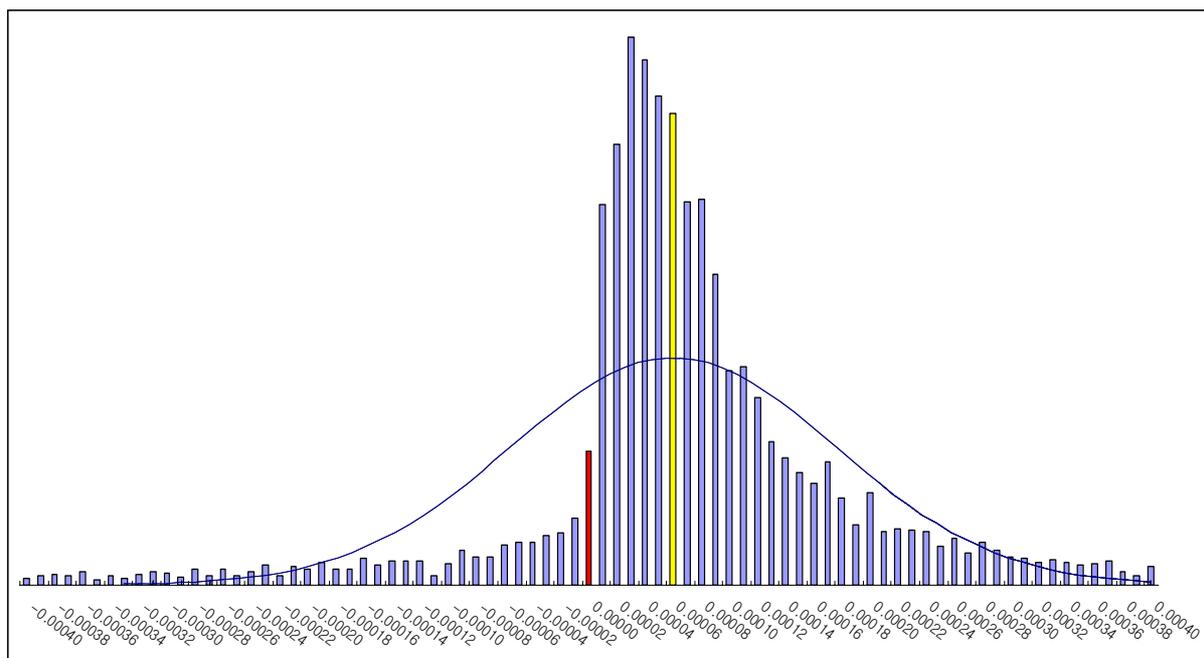


Figure 2. Interval of earnings management to avoid losses