Fundamentals or Fiction: What Drives Equity Pricing?

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This study employs accounting statements, a source of information consistently available to the markets, to study the role of firm fundamentals and investor sentiment in formulating equity prices. We document that while investors use economic factors to price assets, its importance varies significantly over time and other non-economic factors also play a role. We find that during the "dot.com" years of the late 1990s, investors were optimistic and relied less on underlying financial information in valuing equity, and this effect was most pronounced for NASDAQ-listed firms. The "correction" that began in March 2000 led to an increase in the use of accounting data in price formulation over the next two years. However, the enactment of SOX in 2002 had a much greater impact of enhancing the relevance of accounting information, thereby achieving the intended goal of increasing investors' reliance of fundamentals in stock valuation. We also observe a fall in the role of accounting statements in equity pricing during the 2007 financial crisis, suggesting that reduction in stock prices largely resulted from a changes in investor sentiment and economic conditions rather than declining firm fundamentals. We also find no evidence that the accounting scandals and frauds occurring between 1998 and 2001 had a measurable impact on accounting relevance, suggesting that market efficiency prevented a contagion impact on other firms. Our results suggest that equity valuation is not driven solely by fundamentals, but also by sentiment and behavioral factors which impact share pricing.

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1. Introduction

There is an extensive literature in both finance and accounting that examines the extent to which equity prices reflect fundamental values relative to other non-economic factors.[1] These studies suggest that non-economic factors play a role in market valuation. That is, investors, influenced by sentiments, price assets using beliefs that are not justified by accounting information on hand, causing shifts in market values.[2] Most of the tests of this hypothesis generally involve an examination of correlation of returns or of risk-adjusted abnormal returns over an extended time interval or using proxies for investor sentiment.

In this study we distinguish between economic information and investor sentiment in security valuation using a novel approach that is referred to as value-relevance in the accounting literature.[3] The methodology measures the degree to which investors incorporate publicly available fundamental information into stock prices. When investor sentiment is high, that is, when investors rely more on non-economic factors, accounting information explains less of asset prices. Alternatively, when investors primarily use publicly available information to value assets, the influence of sentiment on price is low.

We apply this approach to examine events in the stock markets beginning in the mid-1990s. We

[1] See Lakonishok, Shleifer and Vishny, 1994; Fama and French, 1995; Frankel and Lee, 1997; Dechow, Hutton and Slaon, 1999; Trueman, Wong, and Zhang, 2000; Ofek and Richardson, 2002; Abreu and Brunnermeier, 2003; Baker and Wurgler, 2006 and 2007; among others

[2] Abreu and Brunnermeier (2003) define a theoretical model of asset pricing during technology bubbles. Baker and Wurgler (2006) state that investor sentiment may cause systematic patterns of mispricing.

[3] See Collins, Maydew, and Weiss, 1997; Chang, 1999; Francis and Schipper, 1999 among others.

choose this particular interval because there have been several occurrences that call into question the role of investor sentiment, and by extension, fundamental information, in security valuation. First, between 1998 and 2000 there was a dramatic run up in stock prices in general, and of technology stocks in particular. The rise in equity value has been termed as a "bubble", implying that during this interval investors were overly optimistic and relied less on underlying fundamental information in pricing equity. The bubble burst in March 2000, and the "correction" in the equity market, especially of NASDAQ listed companies implied that stock prices at that time were a better indicator of accounting value than in the late 1990s. Beginning in 2007 the financial markets experienced another upheaval with the bursting of the real estate bubble that was accompanied by a dramatic fall in stock prices.[4] The fall in stock prices beyond that expected from accounting statements suggests an increase in the influence of non-economic factors on stock prices.

We argue that the extreme events described above serve as a natural experiment to test the importance of economic and non-economic factors in equity price formulation. However, we also examine other events that occur over this interval that could be viewed as exogenous shocks but that could potentially significantly impact investors' reliance on fundamental information while valuing securities. First, the misstatements in firms' audited financial statements that resulted in major bankruptcies in early 2000. Second, the passing of the Sarbanes Oxley (SOX) Act of 2002 with its emphasis on increased disclosure and better corporate governance, which had as its intended goal the restoration of the relevance and integrity of accounting information for investors.

We distinguish between the role of fundamental information and investor sentiment in asset pricing by developing a new, more flexible approach to measure value-relevance of accounting data that improves upon the existing methodology in the literature. Our new measure captures the component of stock price not explained by fundamental accounting information. That is, higher values for our construct imply less fundamental information is incorporated in equity prices, implying lower value-relevance of accounting data and hence, higher explanatory power of non-economic factors.

Using a sample of Compustat firms we find that investors' reliance on fundamental information in pricing assets varies dramatically over time. The ability of accounting information to explain equity prices is relatively high until 1997. However, beginning in 1998 and continuing in 1999, a period that corresponded with the technology bubble, we find a dramatic decrease in the role of fundamentals, and this effect is most pronounced for NASDAQ-listed firms that experienced the greatest rise in value. We also document a corresponding rise in the Baker and Wurgler (2006) investor sentiment proxy, especially for NASDAQ listed firms. These results suggest that investor sentiments, as opposed to fundamentals were an increasing determinant of equity prices, especially for technology stocks.

The collapse of the bubble and subsequent decline in prices coincides with a rise in relevance of accounting information, suggesting that equity prices at this time better reflect underlying information. Further, NASDAQ firms that had the largest "correction" experienced the greatest increase in value-relevance. We find little evidence for the argument that accounting scandals and earning restatements influenced investors' reliance on publicly available audited information; while there is some decline in relevance of accounting information around restatements at both firm and industry levels, the results are not consistent across time. Additionally, we find no relationship between a firm's auditor and equity price formulation. Overall the evidence suggests that the market continued to rely on accounting information for firms not implicated in the scandals.

Beginning with the passing of SOX in 2002 we observe a dramatic increase in value relevance of accounting information that peaked in 2006. The result implies that investor confidence and reliance on public accounting data for share price formation rises with an increase in the reliability and integrity of the information. Given that the major goal of SOX was accomplished, this finding provides support for the role of regulation and legislative changes in influencing the usefulness of

[4] Kashyap and Zingales (2010) describe this as "the biggest financial crisis since the Great Depression".

fundamentals in equity pricing.

Finally, we find no evidence that the decline in stock prices associated with the 2007 financial crisis is a result of prior equity overvaluation. There is no rise in the role of non-economic factors in the years preceding 2007. There is, however, a decrease in the market's reliance on fundamentals for the years 2007 and 2008. Combined, these findings suggest that the primary explanation for the stock market decline is investor sentiment caused by the contagion effect of the real estate and banking crisis, rather than equity mispricing or a reflection of declining fundamentals. In general, an examination of the Baker and Wurgler (2006) investor sentiment index across time is correlated with changes in value relevance. The results and conclusions presented in the paper are robust to the alternative measures of value-relevance and the sample composition.

Our general finding of the informative role of accounting information in equity price formulation across several decades is relevant for investors and practitioners. We argue that reliance on fundamental information should be an essential focus of investors in devising an investment strategy. This is important even as the industry composition changes within the economy with the entrance of new firms that cater to new trends as we observed in the late 1990s. While periods of extremely high or low sentiment may reduce the reliance on firm fundamentals, our results show that these intervals are of a limited duration. Over an extended period accounting statements provide a large component of the objective information used to determine stock prices (see Damodaran, 2012). Our results also have important implications for the role of government policy in equity markets. Our findings suggest that legislation actions that improve internal control and increase the reliability of financial statements can impact the extent to which markets use information in asset valuation.

Our paper contributes to the literature in several ways. First, we add to the area of investor sentiment in security valuation by providing a more direct approach to distinguish between fundamental economic information and non-economic factors in equity prices. We incorporate a well-established, economically intuitive methodology developed in the accounting literature that relates information presented in a firm's financial statements to its stock price to achieve this goal. Second, we develop a new measure to capture the relevance of fundamental information that eliminates several of the drawbacks of previous constructs. Combined, this allows us to provide a thorough examination of the time-varying role of investor sentiment in asset prices over an extended interval.

The remainder of paper is organized into the following sections. Section 2 discusses the different models and the methodology used to develop a proxy for value-relevance of accounting information. We develop the hypotheses in section 3 and describe the sample data in section 4. Section 5 reports the results, section 6 presents robustness tests, and we conclude the paper in section 7.

2. Measuring the Relevance of Fundamental Accounting Information

The goal of this study is to examine the time-varying importance of fundamental information and investor sentiment in asset pricing in financial markets. This requires an economically intuitive model that relates information presented in a firm's financial statements to its stock price (termed as value-relevance). The accounting literature uses a number of different models to theoretically capture the relation between equity value and fundamental information. Ohlson (1995) derives a model where equity price is determined by proxies for the income statement (earnings) and the balance sheet (book value). Francis and Schipper (1999) argue that the book value of assets and liabilities can be used to measure accounting relevance. Finally, Core, Guay, and Buskirk (2003) propose a model using factors better suited for the new economy of the late 1990s. Our study

employs a combination of Ohlson (1995) and Francis and Schipper (1999) as our base model and we use the Core, Guay, and Buskirk's (2003) model to test the robustness of our findings.[5]

Studies such as Amir and Lev (1996), Collins, Maydew, and Weiss (1997), Francis and Schipper (1999), Core, Guay, and Buskirk (2003) among others use the explanatory power of equity price regressions against various accounting predictors to assess the usefulness of fundamental information. A higher adjusted R^2 indicates that a greater fraction of a firm's equity value is explained by accounting fundamentals. Alternatively, when adjusted R^2 is low, non-economic factors play an important role in explaining share prices. Change in the relevance of these fundamentals over time is measured by performing across-sample comparisons of the model's adjusted R^2.

A criticism common to this approach is the reliance on the adjusted R^2 as a proxy for "relevance". Brown, Lo, and Lys (1999), Chang (1999), and Easton (1998) argue that this measure is misleading and biased when there is a scale problem or when the dependent variables in the regression are affected by heteroscedasticity. Furthermore, Gu (2007) demonstrates theoretically that even if these two limitations are absent, the sample variations intrinsic to different periods make comparison of R^2 across time periods problematic.

To address all of these problems, we measure the value-relevance of fundamental information using a variation of Gu's (2007) approach. Similar to Gu, we first estimate annually a regression that is a combination of the Ohlson's (1995) and Francis and Schipper's (1999) models that is defined as follows:

$$P_{i,t} = g_0 + g_1 E_{i,t} + g_2 ASSETS_{i,t} + g_3 LIABS_{i,t} + u_{i,t} \quad (1)$$

where $P_{i,t}$ is firm i's market price per share three months after the year's t fiscal year-end, and E_t, $ASSETt$, and $LIABS_t$ are earnings, total assets, and total liabilities respectively, on a per-share basis at the fiscal year-end t for firm i.[6]

The residual obtained from estimating equation (1), $u_{i,t}$, is the component of the stock price of firm i in year t that cannot be explained by fundamental accounting information and is defined to be the pricing error.[7] However, Gu (2007) documents that the relation between pricing errors and price is nonlinear and that the higher priced stocks lack the same ratio of pricing errors as lower priced stocks. Gu's (2007) study controls for nonlinearity by organizing the pooled sample into deciles based on equity price levels.

We extend Gu (2007) by controlling for nonlinearity with pooled regressions of the following non-linear models:

$$u_{i,t} = h_0 + h_1 \widehat{P}_{i,t} + h_2 \widehat{P^2}_{i,t} + e_{i,t} \quad (2)$$

$$u_{i,t} = h_0 + h_1 ln(\widehat{P}_{i,t}) + e_{i,t} \quad (3)$$

where $\hat{P}$ is the predicted share price obtained from equation (1).

We adopt this approach because it provides us with flexibility in specifying the nonlinear relation between equity pricing deviations and the predicted stock price. In alternative specifications

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[5] By separating assets from liabilities we do not require the coefficient on liabilities to be the negative of the coefficient for assets. Similar to previous studies in this area we use the share price three months after the fiscal year-end because generally there is a lag from when a firm closes its book to when the financial statements are published. Using the stock price at this time ensures that the markets actually have the accounting information available to establish the equity price.

[6] Some studies use returns as opposed to the level model of this study. In the return model all variables other than the constant are standardized by market price in the preceding year. The drawback with this approach is the dependent variable is based on approximately 252 daily returns over the year and explanatory variables are observed at one point in time when firms release their annual financial statements. If capital markets are efficient, return models are inherently noisy because information contained in financial variables is impounded in the market price around the time financial statements are issued. The drawbacks of return models are well presented in Figure 5 of Gu (2007).

[7] The term pricing error does not suggest market inefficiency. It merely reflects that portion of equity price formulation not due to accounting fundamentals. We use the term "error" to be consistent with other papers in the literature.

of these models, we add industry fixed effects, year fixed effects, and both industry and year fixed effects. Fixed effects are included to ensure that the coefficients of equations (2) and (3) do not suffer from omitted variable bias.

We obtain the normal pricing error for firms with a predicted share price of $\hat{P}$ by either estimating equations (2) and (3).[8] This is the component of equity prices resulting from the nonlinear scale relationship. The abnormal or true pricing error for each firm in a year is calculated as the absolute difference between the residual from equation (1) and the normal pricing error. Because we estimate four regression specifications each for equations (2) and (3) we obtain eight measures of the abnormal pricing error. The abnormal pricing error reflects that component of the stock price derived from a source other than accounting information after controlling for scale and nonlinearity effects. Therefore, higher abnormal pricing errors indicate a lower relevance of fundamental accounting information and greater role of investor sentiment in equity price determination. We express abnormal pricing errors as a percentage of original stock prices and are referred to as the abnormal pricing error percentage (APEP). We argue that APEP is more pertinent than the abnormal pricing error level of Gu (2007) because the magnitude of mispricing is only relevant compared to the securities market value.[9]

As a robustness test we also examine the inter-temporal pattern of value-relevance of accounting information using the adjusted R^2 measure. We do so despite of the drawbacks enumerated earlier because most studies that examine the issue for the pre-1995 period use this approach. Employing this alternative proxy for value-relevance therefore allows us to compare our results for the pre-1995 period with those of previous studies as well as contrast these findings using the new measure developed in this paper.

We obtain the adjusted R^2 statistics estimating two regression models. The first model presented by Ohlson (1995) expresses the firm's market equity as a function of its earnings and book value and is specified by the following equation:

$$P_{i,t} = a_0 + a_1 E_{i,t} + a_2 BV_{i,t} + u_{i,t} \quad (4)$$

where $BV_{i,t}$ is the per-share book value of equity at fiscal year-end *t*. The second model is the Balance-Sheet model used by Francis and Shipper (1997) that relates the market value of the firm's equity to its assets and liabilities as in the following regression:

$$MV_{i,t} = e_0 + e_1 ASSETS_{i,t} + e_2 LIABS_{i,t} + u_{i,t} \quad (5)$$

where $MV_{i,t}$ is firm's share price. As stated earlier, higher adjusted R^2 indicates higher (lower) relevance of fundamental (non-economic) information in equity valuation.

3. Market and Regulatory Influences on Equity Prices

We hypothesize that a series of recent financial and regulatory events can be explained by the changing relevance of fundamental accounting information for share price formation. For instance, the popular explanation for the significant run-up in equity prices in 1998 and 1999 is the existence of a stock market bubble. This argument suggests that during those years investors influenced by sentiment are increasingly optimistic and incorporate less underlying fundamental information in determining equity prices. Thus, we hypothesize that the APEP is higher over these years, consistent with a lower value-relevance of fundamental accounting information. Technology stocks crashed in early 2000 with prices declining over the next two years. This fall in equity market prices, defined as a "correction" by financial experts, leads us to hypothesize that stock prices in this two-year interval would incorporate a higher level of underlying fundamentals. If this is true APEP is expected to

[8] Fixed effects are not used to calculate the normal pricing error as they are not part of the effect resulting from the nonlinear relationship. As such they are part of the abnormal pricing error.

[9] For example, a $5.00 abnormal pricing error is far more significant to a security selling for $10.00 than for one priced at $100.00.

decrease subsequent to 1999 indicating higher accounting value-relevance.

The period 1997 to 2001 was also marred by several instances of major bankruptcies, where poor financial performance was hidden from the accounting statements by significant deviations from accepted accounting principles.[10] The detection of fraud in accounting statements led many companies to restate their earnings, and these scandals are suggested to have caused an erosion of confidence in the quality and relevance of accounting information. This argument would imply a decline in investors' reliance on accounting data during this interval, that is, higher APEP, and this effect will be most pronounced for firms with questionable accounting practices.

The enactment of SOX in 2002 by Congress is an exogenous event that had as its goal the restoration of investors' confidence in accounting information by improving the accuracy of financial statements and the integrity of the auditing process. Whether the goal was realized remains an empirical question that we test in this paper. If the intended objective of the Act was achieved, investors are more likely to value assets using publicly available information because of greater reliability of the data. This would imply that we should observe an increase in the value-relevance, that is, lower APEP after 2001.

The 2007 financial crisis led to a dramatic decline in equity values. If the decline is a "correction" of prior equity mispricing, we expect an increase in the contribution of non-economic factors in determining equity prices (higher APEP) before 2007 and a corresponding decrease (lower APEP) subsequently. Alternatively, if the reason for the decline is a reduced reliance on fundamentals, then we should observe increasing APEPs beginning in 2007.

4. Sample Construction and Data

We select as a sample period for analysis, the years 1975-2008, with a special emphasis on the 1995-2008 sub-period. Our use of 1975-1994 is motivated by two reasons. First, it allows us to compare our results with those of previous studies such as Collins et al (1997) and Francis and Schipper (1999) to ensure the validity of our data. Second, our results for this period serve as a benchmark to evaluate whether the value-relevance of fundamental accounting information has changed over the more recent past.

We use the Compustat and CRSP databases for obtaining the necessary financial and accounting variables. We apply similar criteria as in Collins et al to obtain the following data for all firms:

(i) Net income/loss (data item 172), total assets (data item 6), total liabilities (data item 181), common equity (data item 60), and common shares outstanding (data item 25) at the fiscal year-end, available in Compustat. To find the per-share value for earnings, total assets, total liabilities, and book value of equity we divide the variables by the number of shares outstanding, adjusted for splits and stock dividends.

(ii) Security prices on the last day of the third month after the firm's fiscal year-end available on the Center for Research and Security Prices (CRSP) Monthly Stock Price file. The market price is adjusted for stock dividends or splits that occur between the fiscal year-end and three months subsequent when the share price is obtained.

(iii) Total assets (data item 6) and book value of common equity are both required to be positive.

These selection criteria result in an initial file comprised of 185,859 firm-year observations. A concern in our analysis is the sensitivity of the least squares regression estimates to extreme values. We use Cook's (1977) D statistic to eliminate observations that have an excessive influence in the regression analysis.[11] This restriction yields a final sample size of 185,590 firm-year observations.

[10] The best known examples are Enron and MCI WorldCom.

[11] We eliminate observations with a Cook's D statistic greater than two. As a robustness test we also eliminate observations with a Cook's D statistic greater than one as in Francis and Schipper (1999) or greater than 4/N, where N is the number of annual observations and obtain similar results.

5. Empirical Findings

The objective of this study is to test whether the changing investor reliance on fundamental accounting information for equity valuation can contribute to an understanding of extreme events such as bubbles and crashes in the financial markets. We do so by examining the role of economic and non-economic factors in determining asset valuation across time. Initially, we investigate the relation for the 1975 to 1994 interval using the adjusted R^2 measure which allows us to compare our results with the findings of previous studies to confirm the validity of our data and the methodology.

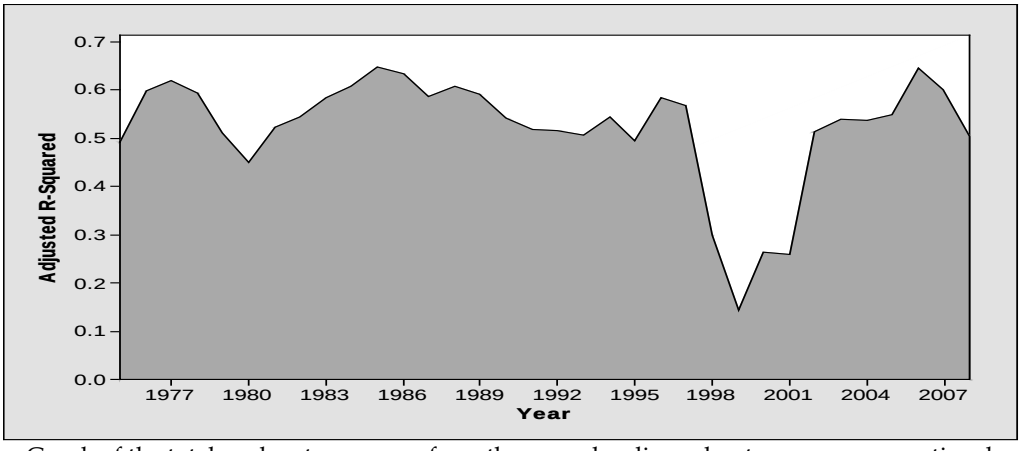
We then proceed to inspect the time-series pattern of value-relevance employing the new measure developed in this paper, that is, APEP, for the entire sample period. We first compare the results for the pre-1995 interval with the adjusted R^2 approach and with the finding of prior studies and then proceed to test the different hypotheses detailed in section 3 for the 1995 to 2008 interval using both proxies for accounting value-relevance.

5.1. Value-Relevance from 1975 – 1994.

We present the results of the adjusted R^2 approach using the Collins et al (1997) and Francis and Schipper (1999) models in Figure 1. We graph the explanatory power of equation (4) in Panel A and of equation (5) in Panel B.

Figure 1

Panel A



Graph of the total explanatory power from the annual ordinary least-square cross-sectional regression of price on earnings and book value.

Panel B:

Graph of the explanatory power from the annual ordinary least-square cross-sectional regression of price on book value of assets and liabilities.

In general, the pattern of adjusted R^2 is similar to that in Collins et al and Francis and Schipper. The model's explanatory power increases from 1975 to 1977, decreases until 1980, increases again until 1987, and decreases after that.

Having confirmed that the results for the 1975 to 1994 period are similar to previous studies that use the same adjusted R^2 approach, we examine the pattern of value-relevance using the new measure that we develop.[12] We present the abnormal pricing error percentages, APEP, for the entire sample period in Table 1. For each year, the APEP represents the median pricing error across all firms for that year.[13] In the first four columns, APEP is calculated by subtracting the normal pricing error from the raw pricing error, estimated using the quadratic model specified in equation (2) (column 1), with industry fixed effects (column 2), with year fixed effects (column 3), and with both industry and year fixed effects (column 4). In columns (5) to (8), we calculate APEP using the four specifications of the logarithmic model of equation (3) to estimate normal pricing error. We also graph the time-series variation in APEP computed using model (8) in Figure 2.[14] As stated earlier, high (low) APEP indicates less (more) accounting information reflected in stock and hence low (high) value-relevance of accounting information. Exclusive of the 1980 to 1987 time period, the temporal pattern of the eight different measures of APEP is generally comparable to that in Figure 1. We observe a decline in APEP until 1977 and an increase until 1980, as well as from 1987 to 1992. The results using this new measure support the conclusion of previous studies.

5.2. Value-Relevance from 1995 – 2008.

The period of importance in this study is the post-1994 interval, for which we present annual APEP results. This allows us to explicitly examine the impact of the different events described earlier on the value-relevance of accounting information. We also present average abnormal pricing errors for the intervals 1995-1997, 1998-2001, 2003-2006, and 2007-2008.

5.2.1. The Stock Market Bubble and its Subsequent Collapse

An examination of Table 1 and Figure 2 suggests that there is a dramatic variation in the relevance of fundamental information in pricing equity after 1994. The importance of accounting information is relatively stable until 1997; APEP obtained from each of the eight models in the 1995 to 1997 interval is comparable to that over the previous two decades. However, beginning in 1998 we find that factors other than accounting information playing an increasing role in security valuation resulting in higher pricing errors. The increase in APEP using models (1) to (4) is about 15 percentage points while APEPs from logarithmic models increase about 11 percentage points in 1998. We observe that abnormal pricing error of each model increases even further in 1999 to the highest level over the entire sample period, suggesting a further decline in investors' reliance on fundamental information. These findings suggest that the dramatic increase in stock prices over these two years is driven primarily by high investor sentiments in equity prices and is consistent with the presence of a "bubble" in share market.[15]

Following the bubble's collapse in 2000, we observe a decline in the APEP of approximately 16 percentage points across all eight model specifications. We observe similar results in panels A and B of Figure 1 where there is a significant increase in the explanatory power of models beginning in

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[12] There are some differences between our approach and the adjusted R squared results. One example can be found in 1982, which was characterized by a severe recession in the U.S. with high unemployment and interest rates and low earnings. The S&P 500 index increased from 122 to 141 (15 percent increase) while average earnings yield declined by about 25 percent. Based on these facts one would expect value-relevance of accounting information to have declined in 1982 relative to the previous year. However, in applying the adjusted R^2 approach of the Ohlson model, we find the explanatory power increases from 0.522 in 1981 to 0.543 in 1982, suggesting that accounting information is better able to explain prices. In unreported results we find that the variance of both EPS and BVPS increased materially over 1980 to 1983 which begs the question whether accounting relevance was actually increasing.

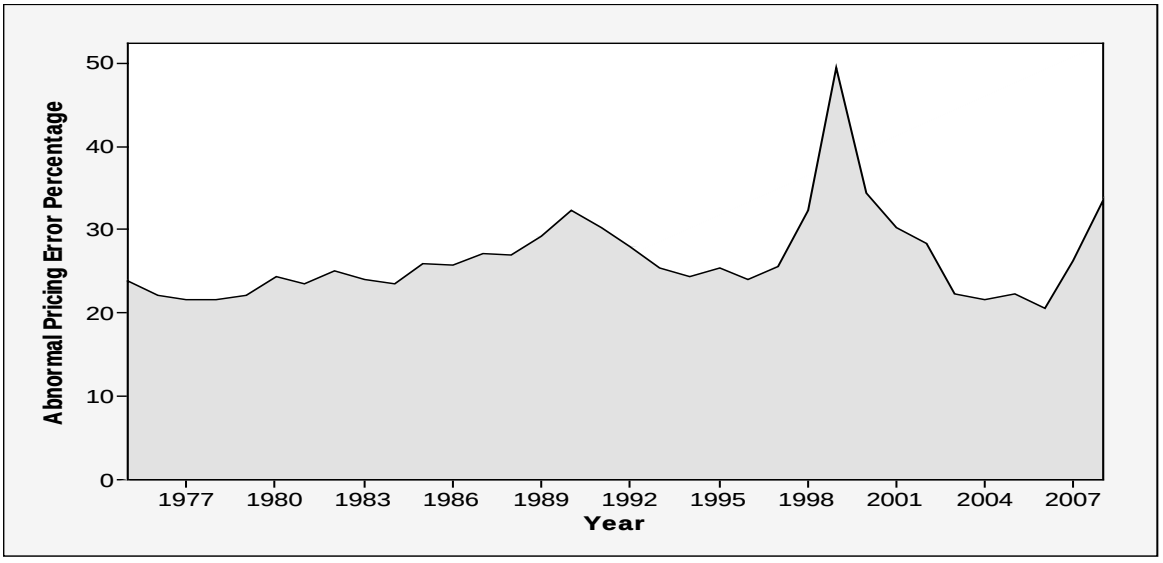
[13] We obtain similar trends if annual APEP is defined to be the mean value across all firms in that year.

[14] The graphs for the remaining seven models are similar in pattern to that in figure 2 and are available upon request.

[15] Although stock prices continued to rise until early March 2000, we do not include this year in the "run-up" interval because only about 10 percent of the firms had fiscal-year ends on March or before.

2000. These findings indicate that "correction' in the financial markets, which is the how the decline was characterized, was a reflection of investors' using fundamentals information rather than non-economic factors in security valuation.

Figure 2



Graph of abnormal pricing error percentages over the years 1975-2008 measuring the value relevance of earnings, total assets, and total liabilities in explaining equity value.

While there is an increase in the role of fundamental information for equity price formation beginning in 2000, APEPs for that and the following year remain higher than those prior to 1998. For example, in 2001, the average (median) APEP across the first four models is 50.97 (51.36) percent while comparable statistics for the 1975 to 1994 period is 36.47 (35.85) percent. These findings suggest that that even though investors incorporate more fundamental information in pricing equity in 2000 and 2001 relative to the bubble period, markets continue to significantly discount the value of accounting information relative to the pre-1997 period.

An alternative but non-mutually exclusive explanation to the "bubble" hypothesis for the low value-relevance over the 1998 to 2001 period is the profusion of accounting frauds, scandals, and earnings restatements that occurred at the same time. Wu (2002) and Jain, Kim, and Rezaee (2008) find evidence that these accounting scandals cause investors to place less emphasis on accounting information. In addition to affecting the restating firms themselves, Gonen (2003) and Xu, Najand, and Ziegenfuss (2006) find the peer industry firms are also significantly impacted, and in the same direction as the restating firms. This finding would imply that the distrust of accounting information is more wide-ranging in nature and this would affect the general value-relevance of financial statements resulting in higher pricing errors. We provide additional tests to distinguish between the asset pricing bubble and the accounting scandals as an explanation for the increase in APEP in the 1998 - 2001 time period later in this paper.

5.2.2. The Effect of Regulation: Sarbanes-Oxley (SOX) Act

SOX was passed in 2002 as a response to a series of highly publicized scandals. In this section we examine whether the passage of SOX and its requirements for greater transparency and enhanced accounting oversight increases the relevance of fundamental accounting data for equity investors and reduced speculation based on sentiment.

Both Table 1 and Figure 2 reveal a remarkable increase in the value-relevance of fundamental information following SOX. On average, the APEP falls by about five percentage points in 2002.

Table 1
Temporal pattern of abnormal pricing error percentages, APEP.

		Quadratic Model				Logarithmic Model			
Years	Average firms per yr.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
1975-1994	4,775.2	44.72	41.36	37.98	32.81	35.92	28.13	25.40	25.37
1975-1984	4,102.2	39.81	36.34	32.96	27.78	31.13	24.12	22.29	23.19
1985-1994	5,448.2	49.62	46.38	42.99	37.84	40.72	32.14	28.51	27.55
1995	7,225.0	47.20	44.07	40.73	35.46	39.70	32.26	27.69	25.32
1996	7,699.0	42.76	39.71	36.05	31.06	35.01	27.61	24.29	24.01
1997	7,771.0	47.72	44.72	41.28	36.88	41.12	34.79	29.96	25.50
1998	7,480.0	62.86	59.52	55.96	50.72	55.52	47.08	40.89	32.30
1999	7,344.0	79.11	76.21	72.77	67.73	73.14	66.35	61.48	49.41
2000	7,065.0	64.84	61.75	58.20	52.59	57.17	48.09	41.79	34.33
2001	6,393.0	56.39	53.04	49.73	44.71	48.86	41.43	35.79	30.28
2002	5,988.0	51.67	48.09	45.22	39.77	42.85	34.68	29.81	28.31
2003	5,761.0	39.19	36.47	33.05	28.20	33.05	26.14	22.74	22.22
2004	5,727.0	39.78	36.82	33.38	28.95	33.31	26.88	23.02	21.61
2005	5,665.0	40.85	37.90	34.75	30.38	35.05	28.92	25.31	22.35
2006	5,207.0	37.88	35.45	32.12	27.83	32.30	26.73	23.35	20.57
2007	5,520.0	50.15	47.17	43.55	38.78	43.17	36.00	31.49	26.33
2008	5,241.0	64.16	61.04	57.33	52.50	55.30	45.97	39.43	33.59
1995-1997	7,565.0	45.90	42.84	39.35	34.47	38.61	31.56	27.31	24.95
1998-2001	7,070.5	65.80	62.63	59.16	53.94	58.67	50.74	44.99	36.58
2003-2006	5,520.2	39.42	36.66	33.32	28.84	33.43	27.17	23.61	21.69
2007-2008	5,380.5	57.15	54.10	50.44	45.64	49.24	40.99	35.46	29.96
Fixed Effects									
Year		No	Yes	No	Yes	No	Yes	No	Yes
Industry		No	No	Yes	Yes	No	No	Yes	Yes

Notes: Abnormal pricing error percentages are calculated using the following steps: First, for each year the error term of the regression, $P_{it} = a_{0t} + a_{1t}E_{it} + a_{2t}ASSETS_{it} + a_{3t}LIABS_{it} + u_{it}$, is computed using ordinary least-square regressions where E, ASSETS, and LIABS are the earnings, book value of assets, and liabilities on a per share basis of firm i at year-end t and P is the market price per share of firm i three months after year-end t. Second, the error term from step 1, is the dependent variable of either a quadratic equation specified as $u_{it} = b_{0t} + b_{1t}PE_{it} + b_{2t}PE^2_{it} + e_{it}$ or a logarithmic equation specified as $u_{it} = c_{0t} + c_{1t}\ln(PE)_{it} + e_{it}$, where PE is the predicted price of step 1 to obtain the normal pricing error. Third, abnormal pricing error is defined as the absolute difference between u and the normal pricing error. Abnormal pricing error percentage is abnormal pricing error scaled by the market price. For each year, APEP is computed as the median of individual firm values. For intervals 1975-1994, 1975-1984, 1985-1994, 1995-1997, 1998-2001, 2003-2006, and 2007-2008, annual abnormal pricing error percentages are averaged across all years in the interval. All standard errors are obtained using White's (1980) correction for heteroskedasticity.

Investors' reliance on accounting information increases even more in 2003, the first full year that SOX is in effect as can be seen by the dramatic decline in pricing errors. By 2006, the APEP for each model is at its lowest level in three decades. In general, over the 2003 to 2006 period, the average annual APEP for each of the eight models is lower than that of the 1975-1994 period. These results suggest that three full years after the enactment of SOX, investors' reliance on accounting information in determining equity prices is at the highest level within the sample period.

The results presented above have two major implications. First, the adoption of SOX appears to be associated with improved investors' confidence in accounting information and hence more fully explains equity prices, thus achieving the primary goal of the Act. Second, traditional financial variables continue to be extremely important in valuing equity post-2002. That is, the relevance of accounting information in stock price formulation is at least as significant now as it was over the previous three decades.

5.2.3. Financial Crisis of 2007.

The financial markets experienced another upheaval in 2007 with the bursting of the real estate bubble. The impact was felt by equity markets where values declined significantly subsequently. However, unlike the crash in 2000 there is no evidence that the fall in equity prices is a "correction" of over-valued assets. There is no dramatic rise in stock prices prior to 2007 as in the late 1990s and this fact is borne out when we examine the pattern of APEP in the period immediately preceding 2007. If stocks rely less on financial statement information and more on non-economic factors, APEP should be increasing prior to 2007. However, between 2003 and 2006 APEP varies over a range of only about three percentage points on average across the eight models, implying that the component of equity prices explained by fundamental accounting information did not change significantly during this period.

The financial crisis of 2007 is accompanied by a rise in the APEP of approximately 10 percentage points across the eight models and a further increase in 2008 when the prices in the equity markets drop dramatically, suggesting that sentiment, as opposed to deteriorating fundamentals, playing a more significant role in the latest equity market collapse. This finding coupled with no evidence of increasing APEP before 2007 leads us to conclude that the decline in share prices results from a contagion of the bursting real estate bubble and the accompanying credit crunch rather than a price correction due to a prior equity overvaluation.

5.3. Accounting Restatements and Value-Relevance

An alternative explanation for the low value-relevance of financial information during the interval 1998 to 2001 is the accounting scandals that occurred during those years. These scandals that sometimes resulted in financial distress and even bankruptcy, led the general public to question the numbers presented in firms' financial statements as well as the competency of auditors certifying the information, contributing to erosion in investors' confidence in the capital market. In this subsection we investigate whether these scandals lowered the relevance of accounting information to investors in determining market prices in the short- and long-run.

We test this hypothesis by examining APEP of companies that restated earnings, events where firms publicly acknowledge questionable financial reporting in accounting statements. Our sample of restatements for the 1997 to 2002 interval is obtained from the General Accounting Office (GAO) of the United States' Government. For this sample of firms, we examine APEP in the year of, the year immediately preceding, and the two year-ends after the restatement. So, for example, if a firm restates in 1997 we examine annual APEP from 1996 until 1999.

The findings presented in Table 2 provide little *consistent* evidence supporting the hypothesis that accounting restatements impacted investors' reliance on financial information in pricing equity. For example, firms that restate in years other than 2000 and 2001 experience an increase in APEP in the year of the restatement, consistent with lower value-relevance. However, we obtain contradictory results for restatement years 2000 and 2001 when we observe a decline in

APEP. Also, across the restatement years, there is no regular pattern in APEP in the interval subsequent to the restatement. For firms restating in 1997, 1998, and 2001 there is a decrease in value-relevance, that is, higher APEP, in the first full year after the restatements, but for all other restating years APEP falls by about five percentage points indicating an increase in the information content of accounting data. The lack of a consistent pattern in APEP around these events leads fails to support the hypothesis that restatements affected investors' confidence in accounting data.

Table 2
Abnormal pricing error percentages, APEP, for firms restating earnings

	Restatement Years					
Relevant Year	1997	1998	1999	2000	2001	2002
1996	32.36					
1997	40.17	26.95				
1998	64.03	54.48	34.41			
1999	47.79	67.23	43.07	42.81		
2000		31.91	38.22	37.27	28.82	
2001			32.39	33.65	28.34	30.09
2002				31.89	33.86	35.63
2003					23.57	23.14
2004						18.83

Notes: Sample of firms that restated earnings are obtained from GAO website. The results are reported for the year-end before, the year-end of and the first and second year-ends immediately after the year-end of restating. Abnormal pricing error percentages are calculated using the following steps: First, for each year the error term of the regression, $P_{it} = a_{0t} + a_{1t}E_{it} + a_{2t}ASSETS_{it} + a_{3t}LIABS_{it} + u_{it}$, is computed using ordinary least-square regressions where E, ASSETS, and LIABS are the earnings, book value of assets, and liabilities on a per share basis of firm i at year-end t and P is the market price per share of firm i three months after year-end t. Second, the error term from step 1, is the dependent variable of a logarithmic equation specified as $u_{it} = c_{0t} + c_{1t}\ln(PE)_{it} + e_{it}$, where PE is the predicted price of step 1 to obtain the normal pricing error. Third, abnormal pricing error is defined as the absolute difference between u and the normal pricing error. Abnormal pricing error percentage is abnormal pricing error scaled by the market price. For each year, APEP is computed as the median of individual firm values. All standard errors are obtained using White's (1980) correction for heteroskedasticity.

While restating financial statements negatively affects the concerned firm, Gonen (2003) and Xu, Najand, and Ziegenfuss (2006) finds that there is a contagion effect to this event. That is, when a firm restates similar firms in the industry also experience the negative impact. Therefore, we replicate our analysis of Table 2 on a sample that includes both restating firms and similar industry firms, which we define as all companies in the same three-digit SIC codes as the restating firm, and with assets that are between 50 percent and 150 percent of the restating firm in the same year. The results that are not tabulated, once again fail to provide a consistent pattern in APEP across and around restatement years.

As an alternative test of the impact of accounting scandals on value-relevance we investigate whether auditor reputation explains high APEPs in 2000 and 2001. The auditing firm of Arthur Andersen is most associated with the irregularities that became public knowledge in 2001.[16] We test whether investors discounted accounting statements of firms audited by Arthur Andersen in these years by duplicating our analysis over the 1992 to 2001 time period (results not tabulated for conciseness) for the firms audited by the five major CPA firms.[17] We find no evidence of

[16] The reasons behind Arthur Andersen's role in these accounting scandals are well documented in the literature. However, we only are interested in whether accounting relevance was impacted by it.

[17] The dissolution of Arthur Andersen in 2002 limits the years we can analyze.

differences in accounting value-relevance between the groups across time. We only detect a time period effect common to all auditing firms where APEP are higher in 1998 and 1999 relative to other years.

However, given the possibility that accounting restatements could impact value-relevance of financial statements, and the fact that these events occurred concurrently with the stock market bubble and the subsequent crash, we replicate the analysis of Table 1 for the post-1997 interval eliminating restating firms and find that the pattern in APEP continues to hold suggesting that results and conclusions presented earlier are robust.

5.4. Exchange Listings and Variation in APEP

In this analysis we examine the relation between exchange listings and the value-relevance of fundamental accounting information. It is well documented that stocks listed on NASDAQ experience a more remarkable rise in prices over the 1998-1999 period than NYSE/AMEX listed firms. The average cumulated value-weighted return was approximately 74 percent for NASDAQ listed firms and only 36 percent for NYSE/AMEX firms. If this dramatic increase in stock prices does not reflect underlying fundamentals, then there should be a greater increase in the APEP for NASDAQ firms vice NYSE/AMEX listed firms.

To test this hypothesis we calculate the average annual APEP for the 1992 to 1997 time period separately for NYSE/AMEX and NASDAQ firms. We also estimate the average annual difference in APEP between these the two exchanges. These results serve as the benchmark against which we compare the value-relevance of fundamental accounting data for the 1998 to 2001 sub-period.

We present our findings in Table 3. We only report results for the logarithmic model with industry and year fixed effects because results from the other specifications are qualitatively identical. Over the 1992 to 1997 interval, the average annual APEP is 21.2 percent for NYSE/AMEX firms and 29.3 percent for NASDAQ listed firms. The lower value-relevance of fundamental accounting data for NASDAQ firms can be attributed to the widely documented fact that NASDAQ companies have systematically different characteristics relative to NYSE/AMEX listed firms and are subject to greater asymmetric information and influence of investor sentiment.

Table 3
Cross-sectional regression results of abnormal pricing error percentages (APEP) by exchange;

	NYSE/AMEX		NASDAQ		
Years	Firms	APEP	Firms	APEP	Difference
1992-1997	2,838.7	21.22	3,766.7	29.28	8.06
1998	2,916.0	25.51	4,099.0	38.73	13.21
1999	2,744.0	34.81	4,153.0	60.03	25.23
2000	2,575.0	27.58	3,874.0	39.65	12.07
2001	2,433.0	24.65	3,391.0	35.20	10.55

Notes Abnormal pricing error percentages are calculated using the following steps: First, for each year the error term of the regression, $P_{it} = a_{0t} + a_{1t}E_{it} + a_{2t}ASSETS_{it} + a_{3t}LIABS_{it} + u_{it}$, is computed using ordinary least-square regressions where E, ASSETS, and LIABS are the earnings, book value of assets, and liabilities on a per share basis of firm i at year-end t and P is the market price per share of firm i three months after year-end t. Second, the error term from step 1, is the dependent variable of a logarithmic equation specified as $u_{it} = c_{0t} + c_{1t}\ln(PE)_{it} + e_{it}$, where PE is the predicted price of step 1 to obtain the normal pricing error. Third, abnormal pricing error is defined as the absolute difference between u and the normal pricing error. Abnormal pricing error percentage is abnormal pricing error scaled by the market price. For each year, abnormal pricing errors are computed as the median of individual firm values. Both regressions are estimated using ordinary least-square regressions. All standard errors are obtained using White's (1980) correction for heteroskedasticity. For interval 1992-1997, 1998-2001, 2003-2006, 2007-2008 the annual abnormal pricing error percentages are averaged across all years in the interval.

Beginning in 1998, the APEP increases for firms on both exchanges indicating a greater role of investor sentiment in security valuation. While the APEP for NYSE/AMEX listed firms increases by about four percentage points in 1998 and 13 percentage points in 1999 relative to the 1992 to 1997 interval benchmark, that for NASDAQ firms increases by 9 and 31 percentage points, respectively. Over these two years the difference in APEP between firms listed on the two exchanges increases, widening to greater than 13 percentage points in 1998 and 25 percentage points in 1999. These results suggest that NASDAQ listed firms, which have a greater run-up in stock prices, was impacted to a greater extent by investment sentiments than firms on NYSE.

This result provides additional support for our conclusion that the steep run-up in prices during the late 1990s especially for NASDAQ-listed firms reflects a speculative bubble driven by non-economic factors rather than value implied by accounting data.

The fall in share prices following the bubble's collapse is also greater for NASDAQ listed firms.[18] If this decline is simply a correction and subsequent share prices are a better reflection of fundamental values, the decrease in APEP should be greater for NASDAQ listed firms. Our results in the last two rows of Table 3 support this conjecture. In 2000, the APEP declined by 21 percentage points for NASDAQ firms and only seven percentage points for NYSE/AMEX firms relative to the previous year. The difference in average APEP between firms on the two exchanges falls to about 12 percentage points in 2000 and 10.5 percentage points in 2001. These results support our general conclusion that events occurring between 1998 and 2001 have a greater impact on the value-relevance of fundamental accounting information for firms listed on the NASDAQ exchange.

5.5. Structural Breaks and Event Clustering

In this sub-section we present alternative tests to investigate the impact of these different events on the value relevance of fundamental information recognizing that structural breaks and event clustering might impact our results. We first examine the structural breaks in the data around the years of our sample events. If the events dramatically affect the relevance of accounting information in equity price formulation as we hypothesize, then we should observe significantly different parameter estimates during the years of the equity bubble, the passage of SOX, and the 2007 financial crisis.

To examine for structural breaks we estimate a pooled regression of equation (1) and include a dummy variable for the years that a particular event occurred and also interact the dummy variable with each of the independent variables. We then test the null hypothesis that the dummy variable and interaction terms are jointly equal to zero using the Chow (1960) test statistic. If there are significant shifts in value-relevance associated with the events, the F-statistics for intervals beginning in 1998, 2003, and 2007 should be significant.

We present the results of our analysis in Panel A, Table 4. We first test for a break over the 1998 to 2001 period. Our results (F-statistic = 518.89; p-value = 0.000) reject the null hypothesis of no structural break, providing further evidence that during the years 1998 to 2001 there is a significant decrease in value relevance compared to the 1975-1997 period. This result supports our conclusion that during the time period of the equity bubble and accounting scandals, the relevance of fundamental accounting information for pricing equity changed.

We next test whether the passage of SOX led to a shift in the relevance of fundamental information. The results of the Chow test (F-statistic = 235.28; p-value = 0.000) once again confirm our earlier conclusion that the enactment of SOX contributed to the dramatic recovery in the value-relevance of fundamental accounting data in equity pricing. Finally, to verify our last finding of a shift in value-relevance in the last two years of the sample period, we re-estimate regression (1) for the 2003 to 2008 sample period. In this case, the dummy variable captures the impact of the interval 2007 and 2008. As previously, we find significant evidence of a structural

[18] The NASDAQ Composite Index lost about half its value one year after reaching its highest point.

shift in value-relevance for 2007 and 2008 relative to the previous four years.

As an alternate test to separate out the marginal impact of these clustered events on APEP, we estimate the following AR(1) regression equation:

$$\Delta APEP_t = a_0 + a_1 \Delta APEP_{t-1} + a_2 DC\ Dum_t + a_3 Sox\ Dum_t + a_4 Crisis\ Dum_t + u_t \qquad (6)$$

where Δ is the change relative to the previous year, *DCDum* is equal to 1 for the beginning of the Dot Com period in 1998 and 0 otherwise; *SoxDum* is equal to 1 for the 2003, the first full year SOX is in effect, and 0 otherwise; *CrisisDum* is a dummy variable for the 2007 financial crisis equal to 0 for all years other than 2007 when its value is 1. We expect the coefficients for *DCDum* and *CrisisDum* to be positive indicating reduced value-relevance of accounting information, while that for *SoxDum* to be negative, implying increased investor confidence in fundamental data.

The results for the eight estimates of *APEP* are presented in Panel B of Table 4. As predicted the coefficients for *DCDum* and *CrisisDum* are consistently positive and significant. This finding implies that the dramatic rise in stock prices during the stock market bubble of the late 1990s and the decline in equity values resulting from the financial crisis of 2007 are associated with an increase in abnormal pricing errors. These results support our earlier conclusion that these events are associated with reduced investor reliance on fundamental accounting data to price equity.

Table 4
Tests for structural breaks in value relevance

Panel A: Chow test for structural breaks using a pooled regression of price on earning, assets, liabilities, a dummy, and interaction terms using the following model.

Model: $P_{it} = e_{0t} + e_{1t}E_{it} + e_{2t}ASSETS_{it} + e_{3t}LIABS_{it} + e_{3t}Dummy + e_{4t}Dummy*E_{it} + e_{5t}Dummy*ASSETS_{it} + e_{6t}Dummy*LIABS_{it} + u_{it}$

Chow Test Years	Firm-Years	F-Statistic
1998 - 2001	152,469	518.89***
2003 - 2006	56,630	235.28***
2007 - 2008	33,121	400.88***

Notes: The Dummy takes a value of 1 for the years 1998-2001 and 0 otherwise for the first regression, takes a value of 1 for the years 2003-2006 and 0 otherwise for the second regression, and takes a value of 1 for the years 2007-2008 and 0 otherwise for the third regression. The sample period for the first set of regressions is 1975-2001, for the second set is 1998-2006, and for the third set is 2003-2008. The coefficients are estimated using ordinary least squares regression. All F-statistics are obtained using White's (1980) correction for heteroskedasticity. ***, **, * indicates statistical significance at the 1, 5, 10 percent level.

Panel B*:* AR(1) regression of yearly change in APEP on the lagged yearly change in APEP.

Model: $\Delta APEP_t = d_{0t} + d_{1t}\Delta APEP_{t-1} + d_{2t}DC\ Dum_t + d_{3t}Sox\ Dum_t + d_{4t}Crisis\ Dum_t + u_t$

	Quadratic Model				Logarithmic Model			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
DC Dum	13.99***	13.62***	13.55***	12.61***	13.37***	11.87***	10.77***	6.67***
Sox Dum	-12.01***	-11.10***	-11.83***	-11.27***	-9.42***	-8.86***	-7.40***	-6.35***
Crisis Dum	12.45***	11.81***	11.49***	10.91***	10.88***	8.91***	7.87***	5.51***

Notes: ΔAPEP is the change in annual abnormal pricing error percentages relative to the previous year. DC Dum is set to one for the year 1998. Sox Dum is assigned a one for 2003. Crisis Dum is assigned a one for 2007. The coefficients are estimated using ordinary least-square regressions of an AR(1) model of changes in APEP. All standard errors are obtained using White's (1980) correction for heteroskedasticity. ***, **, * indicates statistical significance at the 1, 5, 10 percent level.

The coefficient for the SOX dummy is significantly negative, indicating that the APEP declines after the first full year of SOX implementation. This result is of particular importance because the recovery of accounting value-relevance after the bubble burst in early 2000 and the passing of SOX occurred in close proximity to each other. However, the negative coefficient

provides strong support for the hypothesis that the passage of SOX has a significant impact in restoring investors' reliance in fundamental information.

6. Robustness Tests

The results presented earlier suggest that the pattern in value-relevance of accounting information proxied by APEP is consistent with the hypotheses that we put forward earlier. That is, during the bubble of the late 1990s and the financial crisis of 2007 investors' used non-fundamental factors in pricing equity. However, after the "correction" in equity prices beginning in 2000 and the enactment of SOX investors' reliance on fundamental accounting data increased dramatically and that the role of non-economic considerations fell. In this section we test the robustness of our findings adjusting the data for various factors that could affect these results.

6.1. Pattern of Investor Sentiment between 1992 and2006.

In the sub-section we provide supporting evidence for the results presented so far by examining the time series pattern of two proxies for investor sentiment beginning in 1992. These measures of investor sentiment were developed by Baker and Wurgler (2006) and are composite indices of six proxies of investor sentiment. The first measure, SENT-1, is based on equation (3) and the second measure, SENT-2, is based on equation (2) of Baker and Wurgler (2006).[19] We provide the mean and median results for these two measures for the intervals 1992-1997, 1998-2001, 2002-2006, and 2007-2008 in Table 5.

Table 5
Mean and median proxies for investor sentiment from 1992 to 2010

Year	Sent-1	Sent-2
1992-1997	0.08 (0.00)	0.23 (0.14)
1998-2001	0.74 (0.62)	0.74 (0.64)
2002-2006	-0.21 (-0.02)	-0.13 (-0.02)
2007-2008	-0.09 (-0.09)	0.00 (0.00)

Notes: Sent-1 is a sentiment index measure in Baker and Wurgler (2006) that is estimated from Eq. (3) in that paper. This measure is based on the first principal component of six (standardized) sentiment proxies where each of the proxies has first been orthogonalized with respect to a set of macroeconomic conditions. Sent-2 is an alternative sentiment index measure estimated from Eq. (2) in that paper and is based on the first principal component of six (standardized) sentiment proxies.

We observe that investor sentiment is the highest during the 1998-2001 period during which the APEP was the lowest. Further, we find that the passing of SOX in 2002 reduced the role of investor sentiment in equity pricing. In fact, during the 2002-2006 period the median investor sentiment index was very close to 0 and this continued for the last two years of the sample period. However, when we examine annual data, we find that proxies of investor sentiment in 2008, the year the stock market declined dramatically, is -0.27 suggesting that non-economic factors and not changes in fundamentals were the primary explanation for the equity price decline in that year.

We next use multivariate analysis to test the relationship between APEP levels (the dependent variable) and the sentiment index (the independent variable). We define dummies for stocks listed on the NASDAQ (NASDAQ) and the years 1998 and 1999 (DCDum). We create one interaction term between NASDAQ and the sentiment index. A second independent variable interacts the index with NASDAQ and DCDum. We find that the coefficients for both interaction terms are positive and highly significant (results not tabulated for conciseness). This confirms our

[19] These measures are available at the website http://pages.stern.nyu.edu/~jwurgler/. Baker and Wurgler (2006) provide a thorough description of the development of these measures.

conclusion that investor sentiment was a significant explanation for the NASDAQ rise of the later 1990s. It also shows that the generally lower value relevance of NASDAQ firms reported previously can be attributed to sentiment.

6.2. Alternative model for value-relevance

Core, Guay, and Buskirk (2003) develop an alternative model for value-relevance by including proxies for expected earnings growth in tangible and intangible assets, and allowing for different coefficients for profits and losses. They argue that their approach better explains the relation between equity prices and accounting information for the "New Economy" subperiod of the late 1990s than earlier models.

We calculate annual APEP using this model and find that the pattern of abnormal pricing errors is similar to those presented in Table 1 and Figure 2. The pricing errors are relatively low and constant until 1997, increasing dramatically in the following two years and the dropping until 2002 to levels that are higher than the pre-1998 period. Subsequent to 2002, APEP continues to decline and then rise beginning in 2008 implying that the results presented earlier are robust to the accounting model used to calculate value-relevance.

6.3. Negative Earnings and Value-Relevance

Previous studies document that changes in value-relevance of accounting information can be explained by the occurrence of negative earnings and the fraction of non-recurring items in earning. This suggests that the pattern in APEP is more an artifact of earnings composition rather than changes in investor reliance on financial information to price equity. We test for this possibility by restricting our sample to firms that had non-negative earnings and then replicate our analysis.

The pattern of APEP across the 1995 to 2008 period is similar to that in Table 1. We also replicate the Chow Test and AR(1) analyses of Table 4. We continue to find significant structural shifts in APEP during the bubble and scandal era, after the enactment of SOX, and at the start of the 2007 crisis. We conclude that the changing earnings composition does not significantly contribute to an understanding of the pattern in accounting value-relevance.

6.4. Sample Composition and Value-Relevance

We also investigate whether the composition of the sample firms might explain the results presented earlier. One of the characteristics of the DotCom era of the late 1990s is the number of new firms that are incorporated. [20] Previous studies find a strong relation between firm size and value-relevance of accounting information. To control for the confounding effects introduced by new, small firms on our results we replicate our analysis for a sample of firms that have valid annual information on Compustat for the entire 1992 to 2008 time period. For this sub-sample of firms, we obtain results similar to those previously reported in this study. We conclude that the pattern of changing relevance of accounting information for equity pricing is not due to the presence of small firms in our sample.

7. Conclusion

In this paper we investigate the role of fundamental information and non-economic factors such as investor sentiments in valuation of financial securities. We examine stock prices over the last 15 years because certain events that occurred during this interval provide a natural experiment to distinguish between these alternative factors in asset valuation. The spectacular run-up in stock prices in the late 1990s and the subsequent crash suggest that investor sentiment played a major role in that time period. Similarly, the dramatic decline in market value since the 2007 financial crisis suggests non-economic forces playing an important role in price formulation. Other events such as the accounting scandals and the subsequent passage of the Sarbanes-Oxley

[20] We find that the annual number of high tech firms increased from an average of 1,500 during the 1992 to 1997 period to 1,866 in 1998 and 1,979 in 1999.

(SOX) legislation also raise questions regarding the quality of information contained in financial statements and the extent to which investors' rely on this information to value assets.

Employing theoretical models from the accounting literature to measure accounting relevance, we develop a new proxy to measure the evolution of equity price formulation over time. We refer to this measure as the abnormal pricing error percentage or APEP. High APEP indicates that a large fraction of the stock's value cannot be explained by fundamental information and that non-economic factors play an important role in asset pricing. Employing this new measure we obtain a number of important insights regarding equity price formation. There is a decline in the explanatory power of accounting information in the late 1990s that coincides with the extraordinary rise in equity values and this effect is most pronounced for NASDAQ-listed firms. These results suggest that increasing investor sentiment as opposed to fundamental was the major cause of the technology bubble. The bursting of the bubble and the subsequent decline in equity values corresponds with a decline in observed APEPs implying increased importance of accounting data relative to non-economic factors in asset pricing and this relation was most prominent for firms on NASDAQ.

The enactment of SOX in 2002 in response to the scandals led to a decrease in APEP and pricing errors were at the lowest level in 2006. This result suggests that SOX achieved its goal of increasing the reliability and relevance of accounting information in equity valuation. We also observe an increase in APEPs beginning in 2007 and continuing through 2008. This result implies that declining stock prices at the time of the latest financial crisis resulted primarily from other factors than underlying fundamentals. This further suggests that the culprit for the crisis of 2007 is not equity overvaluation, but resides elsewhere. We find no statistically significant evidence that accounting frauds and scandals that occurred in the late 1990s and early 2000 adversely impacted value-relevance of fundamentals.

These results suggest that equity valuation is not solely driven by fundamentals and that there is a role for sentiment and behavioral factors to influence share pricing. These findings also raise a policy issue regarding what can be done to move markets so that valuations are increasingly based on underlying fundamentals. We find that the passage of SOX with its emphasis on disclosure and accounting integrity is associated with closer relation between equity pricing and fundamental information. This raises the question of what more can be done to bring stability to equity markets.

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