Earnings Management?
Alternative explanations for observed discontinuities in the frequency distribution of earnings, earnings changes, and analyst forecast errors

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ABSTRACT

The discontinuities at zero in the frequency distributions of reported net income (deflated by beginning-of-period market capitalization), deflated change in net income, I/B/E/S “actual” earnings, and analysts’ forecast errors are the most widely cited evidence of earnings management. We provide evidence consistent with alternative explanations for each of these discontinuities. We show that firms reporting small losses are priced significantly differently from firms that report small profits. An effect of this difference in pricing is that earnings to the left of zero are deflated by significantly different denominators than earnings to the right of zero inducing a discontinuity in the distributions of deflated net income and deflated changes in net income at zero. We also show that sample selection criteria may contribute to the discontinuity in these distributions as well as the discontinuity in I/B/E/S actual earnings. Finally, the presumption in the literature which focuses on the discontinuity at zero in the distribution of analysts’ forecasts errors is that earnings are managed to meet or beat analysts’ forecasts. We provide an alternative explanation: the discontinuity is caused by the fact that analysts’ forecast errors tend to be much greater when the forecasts are optimistic than when they are pessimistic. This tendency leads to more small positive forecasts errors (pessimistic forecasts) than small negative forecast errors (optimistic forecasts).
1. Introduction

The discontinuities at zero in the frequency distributions of reported net income (deflated by beginning-of-period market capitalization), deflated change in net income, I/B/E/S “actual” earnings and analysts’ forecast errors are the most widely cited evidence of earnings management. Yet there is no unequivocal evidence supporting the pervasive presumption that the discontinuities are due to earnings management. Furthermore, with few exceptions, alternative explanations have not been considered. We provide alternative explanations for each of the discontinuities.

The paper is motivated by our observation that, in stark contrast to the frequency distribution of deflated earnings (see, for example, Burgstahler and Dichev (BD) [1997], Dechow, Richardson and Tuna (DRT) [2003], and Beaver, McNichols, and Nelson (BMN) [2004]), the frequency distributions of both basic and diluted earnings per share do not show a discontinuity at zero. In fact, inconsistent with the presumption of earnings management to exceed a zero earnings threshold, there are more observations with a one-cent per share loss than a one-cent per share profit with a peak in the frequency distribution at zero cents per share. The fact that the discontinuity in deflated

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2 Beaver, McNichols, and Nelson [2004] provide evidence consistent with the following explanations for the discontinuity in earnings frequency distribution at zero: 1) the availability of tax loss carry-forwards and carry-backs, and 2) the observation that losses tend to be more transitory while profits tend to be more permanent. However, their analyses are based on either the frequency distribution of deflated net income (and net income changes) -- similar to the analyses in Burgstahler and Dichev [1997] -- or on regressions based on un-deflated net income (and net income changes) with dummy variables that identify the observations as being in small loss and small profit categories. Since these categories are based on deflated net income, it is not possible to determine whether their results are due to the effect of taxes and transitory items on the distribution of net income or the effects of taxes and transitory items on the distribution of the deflator (beginning-of-year market capitalization).
net income is not observed with earnings per share, suggests that deflation is by no means innocent.\(^3\)

We show that the market appears to price firms that report a profit differently than it prices firms that report a loss. Not surprisingly, price per share for losses is lower than price per share for the equivalent profit. This difference in pricing induces the discontinuity at zero in the frequency distribution of deflated earnings. Our study shows that the median price for firms that report a one-cent loss is $0.25 whereas the median price for firms that report a one-cent profit is $1.31.\(^4\) Hence it is probable that the observed discontinuity in the distribution of deflated earnings is caused by deflation (that is, positive earnings are deflated by prices that are very different to the prices used to deflate negative earnings) rather than the properties of earnings \textit{per se} – in other words, the discontinuity at zero may not be evidence of earnings management as claimed in the extant literature.\(^5\)

In addition, we show that the sample selection criterion requiring beginning-of-year prices exacerbates the discontinuity in the frequency distribution of deflated earnings. We show that the proportion of observations with small losses that are deleted because beginning-of-year price is not available on the Compustat files is greater than the proportion of observations with small profits that are deleted for this reason.

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\(^3\) DRT also show that the discontinuity in the earnings distribution is not observed for earnings per share and they suggest two explanations – selection bias due to deflation by market capitalization and exchange listing requirements. We provide a detailed analysis of the first of these explanations. We also note that a disproportionate number of observations with earnings close to zero trade at less than a dollar and hence there is an exchange listing effect – these “penny stocks” tend to be traded on over-the-counter markets.\(^4\)\(\frac{-0.01}{0.25} = -0.04\) while \(\frac{+0.01}{1.31} = 0.007\). Thus deflating earnings by these numbers would, on average, place one-cent per share losses in earnings/price intervals further from zero than a one-cent per share profits.

\(^5\) Degeorge, Patel, and Zeckhauser [1999] suggest that “since BD deflate earnings, the extreme dip in density just below zero in their distribution of scaled earnings is most likely spurious.” They do not analyze the effects of deflation – rather they examine the distribution of earnings per share and changes in earnings per share.
Consistent with our analysis of the distribution of earnings per share, we do not find a discontinuity in the distribution of change in earnings per share at zero. BMN argue that earnings changes are a noisy version of earnings levels; that is, the sign of earnings changes (increase or decrease) is a correlated, but noisy, signal of the sign of earnings levels (profit or loss). As a consequence, they predict that the discontinuity in (price-deflated) earnings changes is largely driven by the same factors that determine the discontinuity in the distribution of (price-deflated) earnings levels. Consistent with BMN’s contention, we find that the Spearman correlation between earnings levels and earnings changes is 0.39. Thus we suggest pricing differences and sample selection bias as alternative explanations for the discontinuity in the frequency distribution of deflated change in earnings.

Similar to Degeorge, Patel, and Zeckhauser (DPZ) [1999], we show a discontinuity in the frequency distribution of I/B/E/S annual “actual” earnings per share and change in I/B/E/S annual “actual” earnings per share. However, we also show that these discontinuities reflect the fact that the proportion of firms with small losses that are followed by I/B/E/S is much smaller than the proportion of firms with small profits that are followed by I/B/E/S. We also show that these discontinuities are not observed for a sample of firms matched to the I/B/E/S firms on 4-digit SIC code and market capitalization. This evidence suggests that the discontinuity may reflect a tendency for analysts to avoid coverage of firms with small losses – rather than being an indication of

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6 This correlation is the average of twenty annual (1983 to 2002) correlations between earnings per share and change in earnings per share. The associated t-statistic for these correlations is 24.41.

7 DPZ’s earnings per share variable differs from ours -- it is, essentially, I/B/E/S “actual reported” quarterly earnings per share. Although the exact composition of the DPZ sample is not clear, “more than 83,000” of their observations of reported earnings per share out of a total of “more than 100,000” observations come from I/B/E/S reported earnings while the remaining observations are Compustat quarterly data item #8, that is, earnings per share excluding extraordinary items.
management of earnings. Of course, the devils’ advocate may suggest that firms manage their earnings above zero so that they will be followed by I/B/E/S. We cannot rule out this possibility.

Finally, we examine the discontinuity in the distribution of analysts’ forecast errors. Extant literature interprets the predominance of zero forecast errors and small positive forecast errors (as opposed to the lesser number of small negative forecast errors) as evidence of earnings management. We reinterpret the same evidence in the context of analysts’ optimism (an optimistic forecast results in a negative forecast error while a pessimistic forecast results in a positive forecast error). We show that analysts’ forecast errors tend to be much greater when they are optimistic than when they are pessimistic. For example, we show that the median positive forecast error for firms with I/B/E/S “actual” earnings of $0.10 is $0.04 and the median negative forecast error is -$0.09. Similar differences are observed for most other levels of “actual” earnings per share. It follows that observations of positive forecast errors will tend to cluster near zero while observations of negative forecast errors will spread away from zero leading to the frequency distribution observed by DPZ.

Our results have important implications for studies that rely on the discontinuity in the frequency distribution of earnings, change in earnings, and/or forecast errors as evidence of earnings management. We show that there are very plausible explanations other than earnings management for these discontinuities. Therefore, caution should be taken when interpreting the discontinuities as evidence of earnings management to exceed a zero threshold.
The remainder of the paper proceeds as follows. In the next section we describe the data and sample selection process, which differs from prior studies only in choice of sample period. In section 3, (1) we contrast the frequency distributions of deflated net income and earnings per share, (2) we contrast the frequency distributions of deflated change in net income and change in earnings per share, and (3) we examine the distribution of undeflated net income. We also discuss the effects of sample selection bias on the shape of these frequency distributions. Section 4 analyzes the effects of deflation on the frequency distribution of net income. Section 5 examines deflators other than price. Section 6 analyzes the distribution of I/B/E/S “actual” earnings, change in I/B/E/S “actual” earnings, and analysts’ forecast errors. Section 7 offers concluding remarks.

2. Sample selection

The data used in this paper are similar to those used by BD, BMN, and DRT. Requisite data are drawn from the 2002 Annual Industrial and Research Compustat file. As do BD, we eliminate regulated firms as well as financial institutions (SIC codes between 4400 and 5000 and those between 6000 and 6500). In each of our analyses we use all observations for which we have complete data for the variables under consideration. This has the advantage of maximizing the number of observations in any particular analysis and the disadvantage that results are not completely comparable across sets of analysis.8 We provide details of each Compustat data item when we describe its use in our analyses. In later analyses where we consider the subset of firms followed by

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8 All of the analyses in sections 3 and 4 were repeated for a sample where requisite data were drawn from the 1996 Annual Industrial and Research Compustat file (that is, the data were the same as in BD). All results were qualitatively very similar.
I/B/E/S, we include all firms with forecasts of annual earnings on the 2004 I/B/E/S Unadjusted Summary data file for the years 1983 to 2002 inclusive.\textsuperscript{9}

3. \textit{The frequency distributions of earnings (deflated and un-deflated), net income, and change in earnings (deflated and un-deflated)}

The arguments that net income must be deflated “in an attempt to homogenize firms” (see DPZ) or “because firms are drawn from a broad range of firm sizes” (see BD) seem reasonable. The implicit assumption is that deflation will not distort the underlying distribution of net income. We show that it does.

Since deflation distorts the distribution of net income, we focus on the frequency distribution of earnings per share. This focus is supported by two arguments. First, particularly from the viewpoint of the individual investor, earnings per share is not a deflated variable -- it is simply the income due the owner of each share. Second, although the focus of earnings management literature may be on net income, anecdotal evidence suggests that firms, analysts, and shareholders tend to focus on earnings per share. Further, net income is rarely discussed in analysts’ reports or in the popular press – rather the emphasis is on earnings per share.\textsuperscript{10}

We begin this section with a replication of the results of BD showing a discontinuity in the frequency distribution of price-deflated earnings at zero. Then we contrast this with the distribution of (un-deflated) earnings per share and we show the effect of sample selection bias. We next examine the distribution of (un-deflated) net

\textsuperscript{9} Using the I/B/E/S Unadjusted file ensures that we do not introduce the errors which arise when using the file where data are already adjusted for the effects of stock splits and stock dividends (see, Baber and Kang [2002] and Payne and Thomas [2003]).

income and we also show the effect of sample selection bias on this distribution. Finally, we replicate the results of BD showing a discontinuity in the frequency distribution of price-deflated change in earnings and we contrast this distribution with the distribution of change in earnings per share.

3.1 THE DISTRIBUTION OF DEFLATED NET INCOME AND THE DISTRIBUTION OF EARNINGS PER SHARE

We begin by replicating BD, figure 3 – the frequency distribution of net income (Compustat item #172) divided by beginning-of-year market capitalization (price per share (Compustat item #199) multiplied by number of shares outstanding (Compustat item #25)). We report the results in Figure 1, Panel A. Each interval of net income divided by market capitalization is 0.005 wide (as in BD). Consistent with BD, we show a discontinuity in the (price deflated) earnings frequency distribution at zero with the negative interval closest to zero (0.00 to -0.005) containing 748 observations while the positive interval closest to zero (0.00 to 0.005) contains 1,588 observations. The observation that this figure has noticeably fewer observations in the interval immediately to the left of zero and noticeably more observations in the first interval to the right of zero than would be expected in a smooth distribution has been interpreted as evidence of earnings management around zero. Yet despite the visual evidence, there is no

11 Loss intervals are < 0 and ≥ -0.005, < -0.005 and ≥ 0.01, etc. and profit intervals are > 0 and ≤ 0.005, >0.005 and ≤ 0.01, etc. This avoids the need to misclassify zero earnings as either a loss or a profit.

12 We also find a discontinuity in the earnings frequency distribution at zero when net income is deflated by lagged book value (Compustat item #60), total assets (Compustat item #6), sales revenue (Compustat item #12), or number of employees (Compustat item #29).

13 For example, in the textbook, “Financial reporting and analysis,” Revsine, Collins, and Johnson [2005] show the discontinuity in the distribution of deflated earnings reported by BD and DRT and describe it as follows: “The striking feature of this graph is the discontinuity in the number of firms reporting slightly negative earnings versus slightly positive earnings. Substantially fewer firms fall just below zero compared
unequivocal empirical evidence to support the presumption that this discontinuity is the result of earnings management.\footnote{For example, BD show that, consistent with their presumption of earnings management: (1) firms which report earnings just above zero have more cash flow in the prior quarter than firms which report earnings just below zero, and, (2) changes in working capital are higher for firms with earnings just above zero. DRT observe that alternative explanations for these findings are the well-known positive relation between cash flows and earnings and a positive relation between working capital accruals and earnings that may be due to real actions rather than earnings management. Further, DRT, using a variety of accrual models, were unable to find evidence that firms with deflated earnings near zero boosted accruals to report positive earnings. Coulton, Taylor, and Taylor [2004] report similar results for a sample of Australian firms.}

Figure 1, Panel B is the frequency distribution of reported diluted earnings per share (Compustat item #57) for each one-cent interval between -$1.00 and +$1.00.\footnote{All analyses throughout the paper that involve diluted earnings per share are repeated for basic earnings per share. The results are very similar. The conclusions are the same.} The obvious difference between the frequency distributions shown in Panels A and B is evidence of the effect of deflation. Panel B, the frequency distribution of earnings per share, shows no evidence of a discontinuity at zero and, in fact, unlike the frequency distribution of deflated earnings (Panel A), there are significantly more observations (1,850) with a small (one-cent) loss than observations (1,561) with a small (one-cent) profit (t-statistic of 2.72).\footnote{t-statistics throughout this paper are computed using the Fama-MacBeth [1973] method to lessen the effect of cross-sectional dependence. We calculate the mean over twenty annual sets of observations. The t-statistic is the mean divided by its standard error.}

Panel B also reveals a peak in the frequency distribution at zero earnings per share (2,581 observations).\footnote{Small discontinuities in the distribution of earnings per share are evident at 10 cents, 20 cents,…, 90 cents, and one dollar. These discontinuities were also observed by Carslaw [1988] and Thomas [1989]. We observe a very similar frequency distribution to that in Figure 1 for reported basic earnings per share (Compustat item #53) and for earnings per share before extraordinary items (Compustat item #58).} It is interesting to note that of these 2,581 observations, 1,203 report negative net income (in other words, earnings per share are rounded up to $0.00) and 1,251 report positive net income per share. This difference is not significant at the...
0.01 level (t-statistic of 0.71). The remaining 127 firms report zero net income according to Compustat -- that is, their net income is between -$500 and +$500. This evidence of a similar number of firms rounding earnings up to zero earnings per share and firms rounding down to zero earnings per share seems to suggest that net income is not being managed around zero.

3.1.1 The effect of sample selection bias

The requirement that firm-year observations have data for lagged price (required in the calculation of beginning-of-year market capitalization) considerably reduces the sample size. More importantly, a greater proportion of loss firms (compared with the proportion of profit firms) are deleted from the sample for this reason.

Figure 2, Panel A, shows the frequency distribution of earnings per share for the sub-sample of observations with beginning-of-year price available on the Compustat Annual file. In contrast to distribution of earnings per share for all firms (Figure 1, Panel B -- where there were significantly more observations of -$0.01 than observations of +$0.01) there is now no longer a significant difference between the number of observations of earnings per share of plus one cent and the number of observations of earnings per share of minus one cent. The reason for this change in the shape of the distribution is evident upon examination of Figure 2, Panel B, which shows the distribution of earnings per share for observations which do not have beginning-of-year price per share available on Compustat. There are significantly more observations of a one-cent loss (755) than observations of one-cent profit (532) (t-statistic for the difference is 3.80). It is evident from Figure 2, Panel B that, since a larger proportion of loss firms are deleted from the sample because of an inability to calculate beginning-of-
year market capitalization, the discontinuity of the (deflated) earnings distribution at zero may be partially due to this sample selection criterion.\textsuperscript{18}

3.2 THE DISTRIBUTION OF UN-DEFLATED NET INCOME

Researchers seeking evidence of earnings management are interested in the possibility that managers may attempt to manage undeflated net income. As noted previously, the argument that net income must be deflated because firms have very different sizes seems reasonable. However, a problem will arise if, in the process of deflating, the underlying distribution of net income is distorted. To directly examine this possibility, we, like DRT, partition firms into $100,000 intervals of net income and examine the frequency distribution of net income around zero. Figure 3, Panel A shows the frequency distribution of net income for all observations of net income on the 2002 Compustat annual files. In contrast to the result in DRT figure 9(a), our distribution does not exhibit a discontinuity at zero. We show (below) that this difference is due to sample selection bias.

3.2.1 The effect of sample selection bias

We noted in section 3.1.1 that a larger proportion of loss firms do not have a prior year price available on the Compustat annual files. To determine whether the difference between the frequency distribution in Figure 3, Panel A and the distribution in DRT is due to the fact that DRT imposed this sample selection criterion, we examine the frequency distribution of net income for the sub-sample of our observations which had

\textsuperscript{18} Forty-one percent of loss observations do not have beginning-of-year price available while only 34 percent of profit observations do not have an available beginning-of-year price.
beginning-of-year prices available on Compustat (Figure 3, Panel B). The discontinuity at zero, which DRT observed, is now evident. For example, while 1,150 firms report net income between -$200,000 and -$100,000, there are only 1,035 in the interval, -$100,000 to $0. In contrast, there are 1,702 observations in the interval $0 to +$100,000 (the difference between the number of observations in the two smallest net income intervals to the left and right of zero is significant at the 0.01 level (t-statistic of 8.23)).

Comparing the two panels of Figure 3, it is interesting to note that the number of observations in the smallest negative net income interval (-$100,000 to $0) in Panel B, which excludes Compustat firms without beginning-of-year price, is 44 percent (1,035/2,329) of the number of observations in the same interval in Panel A, which includes all Compustat observations. In contrast, the proportion of observations in the smallest positive net income interval ($0 to +$100,000) is 54 percent (1,702/3,168) of those in the same interval in Panel A. In other words, a greater proportion of small loss firms are eliminated.

It is also interesting to note that the proportion of observations in the net income interval -$200,000 to -$100,000, which do not have beginning-of-year price, is 56 percent (1150/2053) whereas this proportion is 44 percent for the interval -$100,000 to $0. This difference is significant at the 0.01 level (t-statistic of 9.95). In other words, there are a significantly higher proportion of observations removed from the net income interval -$100,000 to $0 than from the intervals to its left or to its right. It follows that a possible explanation for the discontinuity in the distribution of net income, observed by DRT, is sample selection bias.
3.3. THE DISTRIBUTION OF CHANGE IN EARNINGS

A comparison of the distributions of price-deflated change in net income with change in earnings per share leads to a conclusion that is similar to the conclusion drawn from the comparison of the distributions of price-deflated net income and earnings per share: the discontinuity in the distribution of price deflated change in net income at zero may be due to deflation by price rather than a discontinuity in the distribution of change in net income \textit{per se} due to, say, earnings management as presumed in much of the extant literature. This is not surprising in view of the fact that the Spearman correlation between earnings per share and change in earnings per share for our sample of observations is 0.39 (t-statistic of 24.41).

Figure 4, Panel A replicates BD, figure 1 – the frequency distribution of change in net income deflated by beginning-of-year market capitalization (the intervals are 0.0025 wide -- as in BD).\textsuperscript{19} Consistent with BD, we show a discontinuity in the (price deflated) change in net income frequency distribution at zero. The interval from 0.00 to -0.0025 contains 1,301 observations while the interval from 0.00 to + 0.0025 contains 1,746 observations.

Figure 4, Panel B is the frequency distribution of change in reported diluted earnings per share for each one-cent earnings-change interval between -$1.00 and +$1.00. The obvious difference between the frequency distribution change in earnings per share and the frequency distribution for deflated change in net income is striking and suggests that the discontinuity in the distribution of deflated change in net income is due to the deflation rather than earnings management.

\textsuperscript{19} Negative change in deflated net income intervals are \(< 0\) and \(\geq -0.0025\), \(< -0.0025\) and \(\geq -0.005\), etc. and positive change in deflated net income intervals are \(> 0\) and \(\leq 0.0025\), \(> 0.0025\) and \(\leq 0.005\) etc. We do not include the 43 observations of zero change in net income in the frequency distribution.
Although there does not appear to be evidence of a discontinuity in the frequency distribution of change in earnings per share at zero, there is evidence of asymmetry of the distribution around zero. There are obviously more observations with a positive change in earnings per share than observations with a negative change in earnings per share (for example, there are 1,634 observations with a change in earnings per share of -$0.01 and 2,166 observations with a change in earnings per share of +$0.01 – this difference is significant at the 0.01 level – t-statistic of 14.15). Of course much of this asymmetry may be due to inflation. The line super-imposed on Figure 4, Panel B, shows the distribution of change in CPI-deflated earnings per share. Much of the asymmetry is removed (t-statistic for the difference between the number of observations with a -$0.01 CPI-adjusted change in earnings (1,865) and the number of observations with +$0.01 CPI-adjusted change in earnings (2,169), while still significant (t-statistic of 4.49), is now much smaller).

Arguably, much of the asymmetry that remains after adjusting for inflation may be explained by the expectation that fewer firms with a negative change in earnings will survive and firms that have survived for sufficiently long enough to enter the Compustat data base are more likely to have earnings increases than earnings decreases.

4. **The effect of deflation**

This section shows why the distribution of earnings per share differs from the distribution of deflated net income. Our focus is on documenting the differences between observed levels of the deflator for loss firms and the levels of this deflator for profit firms. Since the most common deflator used in the extant literature is lagged price, we begin by examining the differences between the beginning-of-year price per share
(Compustat item #199) of firms that report a small loss and the beginning-of-year price per share of firms that report a small profit.\textsuperscript{20}

As an illustration of the main point of the analyses in this section, we first focus specifically on the sub-sample of firms that report either a profit of one-cent per share (1,561 observations), zero earnings per share (2,581 observations), or a loss of one cent per share (1,850 observations). Recall that of the firms that report zero earnings per share, 1,251 report positive net income and 1,203 report negative net income. Thus, in this sub-sample, there are slightly fewer firms reporting positive net income than negative net income (2,812 compared with 3,053).\textsuperscript{21} Yet, we find that when this sub-sample of observations is deflated by beginning-of-year price, there are far more observations in the first BD interval to the right of zero than in first BD interval to the left of zero. This apparent discontinuity in the distribution of (deflated) earnings around zero is due to differences in the beginning-of-year prices of loss firms compared with the beginning-of-year prices of profit firms. In other words, the deflator for firms that report a small loss is generally much lower than the deflator for firms that report a small gain. Further analyses show that the pricing difference between profit observations and loss observations is pervasive.

We begin by elaborating on the difference in the deflator for firms that report earnings per share of minus one-cent, zero, or plus one-cent. Then we do a similar analysis for firms that report net income that is close to zero (between -$100,000 and

\textsuperscript{20} Since deflating net income by market capitalization (net income/(price per share x shares outstanding)) is equivalent to deflating earnings per share by price per share, price per share is the implicit deflator used in most extant studies of the discontinuity in the frequency distribution of earnings at zero.

\textsuperscript{21} This difference is not statistically significant at the 0.01 level (t-statistic of 0.061).
Finally we expand the analysis of beginning-of-year price differences to firms that report earnings per share between -$1.00 and +$1.00.

4.1 MORE DETAILED ANALYSES OF FIRMS REPORTING VERY SMALL LOSSES AND VERY SMALL PROFITS

4.1.1 The distribution of price-deflated earnings per share

The graph in Figure 5, Panel A shows the frequency distribution (using the BD interval widths) of net income deflated by market capitalization for the sub-sample of observations that report one-cent profit per share, zero earnings per share, or a loss of one-cent per share. Despite the fact that, in this sub-sample (firms with a beginning-of-year price), there are only slightly more firms that report positive (vs. negative) net income (1,662 vs. 1,560), many more of these firms are classified by BD as small profit (vs. small loss) firms. For instance, there are 666 observations in the first BD interval to the right of zero (0 to +0.005) and only 239 observations in the BD first interval to the left of zero (0 to -0.005). This difference is statistically significant at the 0.01 level (t-statistic of difference 14.71). Similarly, there are 197 observations in the second interval to the right of zero (+0.005 to +0.01) compared to 118 observations in the second interval to the left of zero (-0.005 to -0.01). This difference is also statistically significant at the 0.01 level (t-statistic of 4.56).

These results suggest that the firms that report a small profit tend to have higher beginning-of-year prices, and when net income is deflated by these higher prices, relatively more of the earnings observations are drawn toward zero whereas the lower beginning-of-year prices for firms that report a loss tend to push relatively more of the earnings observations away from zero. To gather more evidence as to whether there is a
significant difference in pricing on either side of zero earnings per share, which contributes to the observed discontinuity at zero in the distribution of price-deflated earnings, we examine the distribution of price for these firms.

4.1.2 Differences in the deflator – beginning-of-year price

Figure 5, Panel B is the frequency distribution of beginning-of-year prices for firms with earnings per share between -$0.01 and +$0.01. The histogram compares beginning-of-year price for firms with positive net income with beginning-of-year price for firms with negative net income. We show prices ranging from $0.00 to $3.00 with ten-cent interval widths. Consistent with the results in Figure 5, Panel A, it is evident that firms with negative net income have a greater number of lower beginning-of-year prices while firms with positive net income tend to have a greater number of higher prices.\(^{22}\) For example, 775 of the 1,560 observations that reported negative net income have a price less than $0.20 whereas 391 of the 1,662 firms that reported positive net income have a price less than $0.20 (this difference is significant at the 0.01 level -- t-statistic of 6.02). Relating the effect of these pricing differences back to Figure 5, Panel A, these lower beginning-of-year prices for firms that report a loss will push relatively more of the earnings observations into intervals further away from zero whereas the higher beginning-of-year prices for firms that report a profit will draw relatively more of the earnings observations into intervals closer to zero.

\(^{22}\) Although we are primarily interested in the effect of beginning-of-year price on the distribution of (deflated) earnings rather than the relations between \textit{ex post} forward earnings and price, we note that higher (lower) prices for firms that report a profit (loss) for the forthcoming period is consistent with a rational expectations valuation model where the payoff is either earnings or closely related to earnings (for example, cash flow or dividends).
In this section, we focus on the sub-sample of firms that report net income that is close to zero (between -$100,000 and +$100,000) rather than those that report earnings per share close to zero. We saw in Figure 3, Panel B that there are 1,035 firms that report net income between -$100,000 and $0 and 1,702 that report net income between $0 and +$100,000. In other words, there are 1.64 times more firms with small positive net income than small negative net income (which have prior year price available). The graph in Figure 5, Panel C shows what happens when these net income observations are deflated by market capitalization. Intervals are the same width as those in BD. Now we see that 2.90 times more firms (703) fall in the BD category immediately to the right of zero than in the BD category immediately to the left of zero (242). This is yet further evidence that deflating by market capitalization may, at least, exacerbate any discontinuity in the earnings distribution at zero by drawing more of the positive net income firms into intervals close to zero while spreading those with negative net income (of a similar magnitude) away from zero.

Finally, Figure 5, Panel D focuses directly on the deflator (beginning-of-year market capitalization) most often used to deflate net income. The histogram represents firms that report net income between -$100,000 and +$100,000 and separates firms that report positive net income from firms that report negative net income. Market capitalization intervals shown range from $1 million to $43 million; each interval is $1 million wide. It is evident that more firms which report negative net income have very small market capitalization compared to firms which report positive net income. For
example, 340 of the firms that reported negative net income had a market capitalization of less than $1 million whereas only 282 firms that reported positive net income had a market capitalization less than $1 million (the t-statistic for the difference is 2.69).

The significantly lower market capitalization for firms that report a loss will push relatively more of the negative net income observations away from zero, whereas the higher market capitalization for firms that report a profit will draw relatively more of the positive net income observations toward zero.

4.2 A MORE COMPREHENSIVE ANALYSIS OF PRICING DIFFERENCES BETWEEN LOSS AND PROFIT FIRMS

Figure 6 is the distribution the 5th, 25th, 50th, 75th, and 95th percentiles of price per share as well as the mean price per share for each one-cent earnings per share interval between -$1.00 and +$1.00. As seen in the earlier analyses in this section (and, as expected), prices for firms reporting losses are pervasively lower for each one-cent interval than prices for firms reporting the equivalent profit. For example, the median beginning-of-year price per share for a $0.01 per share profit is much higher ($1.31 per share) than the median beginning-of-year price per share for a $0.01 per share loss ($0.25 per share).

23 We are deliberately silent on the valuation model that may underpin the observed empirical relation between beginning-of-year prices and earnings. Our focus is on the effects of using price as a deflator when considering the distribution of (deflated) earnings around zero. The valuation relations between market metrics and earnings have been examined extensively elsewhere and, more recently, the valuation difference between loss firms and profitable firms has been addressed by, for example, Hayn [1995], and Collins, Pincus, and Xie [1999]. These studies examine the relations between returns and earnings and multivariate relations between prices, earnings, and other accounting data. However, no studies of which we are aware, examine the uni-variate relations between prices and earnings when earnings are negative. Our main point is that, if the deflator (price or any other deflator) differs between loss firms and profit firms, deflation may at least exacerbate a discontinuity in the distribution of deflated earnings at zero.

24 Price is Compustat item #199 for the prior year. We report means after deleting the highest one percent of observations of price per share at each one-cent earnings per share interval. Some means are much larger when these observations are included.
In addition, beginning-of-year price per share appears to increase at a higher rate as profit per share increases than it does as loss per share increases. For example, median beginning-of-year price per share is $3.00 when profit is $0.10 per share and median beginning-of-year price per share is $9.00 when profit is $0.50 per share, as compared to loss firms where beginning-of-year price per share is $1.25 for a loss of $0.10 and $3.00 for a loss of $0.50.

In light of the pervasive use of beginning-of-year price as a deflator in studies of the discontinuity in the distribution of deflated net income at zero, we provide a detailed analysis of the difference in beginning-of-year prices between firms reporting profits and firms reporting losses. In Table 1 we report the difference (and t-statistics for the test of the significance of this difference) between the mean (and the median) beginning-of-year price per share for observations of +$0.01 earnings per share and observations of -$0.01 earnings per share. We also report these statistics for comparisons of beginning-of-year price for observations of +$0.02 and -$0.02, +$0.03 and -$0.03 and +$0.04 ≤ earnings per share ≤+$1.00 and -$0.04 ≥ earnings per share ≥ -$1.00. It is evident from Table 1 that the means and the median beginning-of-year price per share for firms making a profit are significantly greater than the means and the medians for firms making the equivalent per share loss.

Un-tabulated results show that the beginning-of-year price differences between the positive earnings per share and negative earnings per share of the same amount are

25 Although the focus of our paper is on the effects of differences in prices between loss firms and profit firms, the very low prices of loss firms is difficult to ignore. The observation that the median beginning-of-year price per share is less than one dollar for firms that report zero earnings per share or a small loss per share is particularly interesting because trading rules on the NYSE, AMEX, and NASDAQ exchanges state that stocks will be de-listed if they trade at less than one dollar for 30 trading days. The percentage of observations which have a price per share less than $1.00 increases steadily from 56 percent when earnings per share are -$0.04 to 71 percent per share when earnings per share are -$0.01, the percentage drops to 66 percent when reported earnings per share is zero and to 43 percent when reported earnings are $0.01.
significantly different for every one-cent earnings per share interval between (+/-) $0.01 and (+/-) $1.00 (the lowest t-statistic for the difference in medians is 4.56 (for the difference between beginning-of-year price per share for firms reporting a profit of $0.36 and beginning-of-year price per share for firms reporting a loss of -$0.36) and the lowest t-statistic for the difference in means is 4.04 (for the difference in means of firms reporting +$0.03 and -$0.03)).

In summary, the deflator (beginning-of-year price) for loss observations is significantly lower than the deflator for profit observations. It follows that dividing net income by market capitalization, as is done in much of the literature of earnings management around zero, will distort the distribution, drawing profit observations toward zero and spreading loss observations away from zero.\footnote{Jacob and Jorgensen [2004] replicate BD’s analysis of deflated annual net income using the sum of any four consecutive quarterly net incomes (that is, annual net income = quarters 1+2+3+4, or quarters 2+3+4+1, or quarters 3+4+1+2, etc.) and find the BD discontinuity at zero is observed only in the fiscal-year sequence (quarters 1+2+3+4). This appears to provide evidence that earnings are managed on a fiscal year basis, thus the discontinuity is not the result of scaling. However, we find that beginning-of-year prices for firms that make small losses are significantly lower in the fiscal year (quarter 1+2+3+4) than any of the constructed years (which begin with quarters 2, 3, and 4). There are no significant differences for firms that make small profits. These price differences have the effect in the fiscal year sequence of quarters (1+2+3+4) of moving loss observations into earnings/market capitalization intervals further away from zero, thus contributing to the observed discontinuity.}

5. \textit{Other deflators}

We have repeated all of the analyses in section 4 replacing beginning-of-year market capitalization with beginning-of-year total assets and with sales revenue and replacing beginning-of-year price per share with beginning-of-year total assets per share and with sales revenue per share. The conclusion that deflation induces a discontinuity in the earnings (and change in earnings) distribution at zero holds for these deflators as well.
since they also differ to the left and right of zero. As an illustration of the similarity of the results and, thus, the conclusions, we include, as Table 2, an analysis of total assets per share similar to the analysis of price per share summarized in Table 1. Of course, the main point of our analyses will apply to any deflator that differs systematically between loss firms and profit firms.27

Arguably, earnings per share are yet another form of deflated net income and the denominator (in the calculation of fully diluted earnings per share, the weighted average number of shares outstanding adjusted for dilutive securities) may affect its distribution.28 Although there are several reasons why this argument may be moot in the context of management of earnings around a zero threshold, we briefly address this issue.

Reasons why the argument may be moot include: (1) earnings per share *per se* (rather than net income) is a focus of attention of investment analysts and investors, (2) as Guay [2002] observes, management of earnings per share via a change in the number of shares outstanding is a highly visible activity which would obviously be ineffective if the intent of managing earnings is to obscure what is actually happening in a firm, and (3) management of earnings from negative to positive can not be done by managing shares outstanding alone.29 Nevertheless, firms may attempt to “manage” earnings per share by changing the number of shares outstanding. They could do this by issuing more stock,

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27 In some situations (for example, in not-for-profit hospitals examined by Leone and Van Horne [2003] and Bouwens, Hollander, and Schaepens [2004]) the focus is obviously on net income rather than per share income and scaling to permit analyses of firms that differ considerably in size is necessary. The evidence in this paper suggests that, in studies such as these, researchers should, at least, check to ensure that the deflator does not differ systematically across profit and loss observations.

28 Basic earnings per share is net income adjusted for preferred dividends divided by the weighted average of the shares outstanding over the fiscal period. Fully diluted earnings is a similar ratio that takes account of the effects of dilutive shares on both the numerator and the denominator.

29 On the margin, it is possible that the cash received from the issuance of new shares could be used to boost income from negative to positive.
splitting the stock (thus, lowering the loss or the profit per share), by repurchasing stock, or via a reverse stock split (thus, increasing the loss or the profit per share).

If the number of shares outstanding is pervasively larger for loss observations than for profit observations, the higher number of observations with very small negative earnings per share (compared with the number of observations with small positive earnings per share) seen in figure 1, Panel B may be, at least partially, due to number of shares outstanding. But the number of shares outstanding does not appear to be larger for loss observations than for profit observations. Untabulated results show that there are only eight intervals between +/- $0.01 and +/- $1.00 where there are significantly (at the 0.01 level) more shares in the loss interval than in the corresponding profit interval (t-statistics range from 1.99 to 3.41) and there are 67 one-cent intervals where there are significantly fewer shares outstanding for the loss interval compared with the same profit interval (t-statistics range from 1.99 to 9.67).

Since managing earnings by adjusting the denominator implies changing the number of shares outstanding, we also examine the proportion of firms with an increase in the (split adjusted) number of shares outstanding and the proportion of firms with a decrease in the (split adjusted) number of shares outstanding. Untabulated results show that the difference between the proportion of profit observations with an increase in the number of shares outstanding and the proportion of observations with the same per-cent loss with an increase in the number of shares outstanding is not significant (at the 0.01 level) for any one-cent interval between +/- $0.01 and +/- $1.00. Similarly, the difference between the proportion of profit observations with a decrease in the number of shares outstanding and the proportion of observations with the same per-cent loss with a
decrease in the number of shares outstanding is not significant (at the 0.01 level) for any one-cent interval between $+0.01$ and $+1.00$.

6. Analysts’ Forecasts

Our final analyses focus on the discontinuity in I/B/E/S actual earnings and analyst forecast errors. DPZ show an obvious discontinuity in the distribution of quarterly earnings per share and change in quarterly earnings per share at zero among firms followed by analysts. We replicate this result with I/B/E/S annual earnings per share and change in I/B/E/S annual earnings per share. We show that these discontinuities reflect the fact that the proportion of firms with small losses that are followed by analysts is much smaller than the proportion of firms with small profits that are followed by analysts. We also show that these discontinuities are not observed for a sample of firms matched to the I/B/E/S firms on 4-digit SIC code and market capitalization. This evidence suggests that the discontinuity may reflect a tendency for analysts to avoid coverage of firms with small losses rather than the common explanation -- earnings management.

DPZ also show an obvious discontinuity in the distribution of analysts’ forecast errors. Extant literature interprets the predominance of zero forecast error and small positive forecast errors (compared with the lower number of small negative forecast errors) as evidence of earnings management. We reinterpret the same evidence in the context of analysts’ optimism: an optimistic forecast results in a negative forecast error while a pessimistic forecast results in a positive forecast error. We show that analysts’ forecast errors tend to be much greater when they are optimistic than when they are
pessimistic. For example, we show that the median positive forecast error for firms with actual earnings of $0.10 is $0.04 and the median negative forecast error is -$0.09. Similar differences are observed for most other levels of actual earnings per share. It follows that observations of positive forecast errors will tend to cluster near zero while observations with negative forecast errors will spread away from zero leading to the frequency distribution observed by DPZ.

6.1 DISTRIBUTIONS OF I/B/E/S EARNINGS PER SHARE AND CHANGE IN I/B/E/S EARNINGS PER SHARE

The distributions of I/B/E/S annual earnings per share and change in I/B/E/S annual earnings per share are shown in Figure 7, Panels A and B, respectively. Panel A demonstrates a dramatic step in the distribution of earnings per share at zero. Specifically, only 132 firms report a loss of one cent while 191 firms report a profit of one cent (the difference is statistically significant -- t-statistic of 3.14). Panel B also shows a large step at zero with fewer firms reporting negative changes in earnings rather than positive changes. For example, 387 firms show a change of minus one cent while 496 show a change of plus one cent. This difference is also statistically significant (t-statistic of 4.49). While at first glance this may appear to be earnings management by the I/B/E/S firms, we next show (below) that it reflects the fact that I/B/E/S follows many less small loss firms than small profit firms.

Figure 8, Panel A shows that I/B/E/S follows only 4.4 percent of the firms included in the Compustat Annual files from 1983 to 2002 that report a one-cent loss, while at the same time following 11.6 percent of firms that report a one-cent profit (this
difference is significant at the 0.01 level -- t-statistic of 7.41). This difference alone could cause almost a three-fold difference between the number of I/B/E/S firms that report a one-cent loss and the number of firms that report a one-cent profit. It follows that the discontinuity in the distribution of earnings at zero observed by DPZ is, by no means, clear evidence of earnings management.

Similarly, Figure 8, Panel B focuses on change in earnings and shows the proportion of firms included in the Compustat annual file from 1983 to 2002 followed by I/B/E/S. The proportion of Compustat firms that report a one-cent decrease in earnings that are followed by I/B/E/S during this period is 15.6 percent whereas the percentage of firms that report a one-cent increase in earnings that are followed by I/B/E/S is 18.1 percent (t-statistic for difference is 2.19). Although the asymmetry in the distribution of the proportion of firms followed by I/B/E/S around zero change in earnings is not as apparent as it is for the distribution around zero earnings, the observation that relatively few firms with near zero earnings and near zero earnings changes are followed by I/B/E/S suggests that the discontinuity in the distribution of earnings changes and earnings levels at zero observed by DPZ is not clear evidence of earnings management.

The above results could reflect (1) greater incentives for firms to manage earnings if the firm possesses characteristics correlated with the presence of analyst coverage, or (2) analysts’ preferences to follow firms with profits and a preference to avoid firms with losses.

In an attempt to disentangle these two explanations, we compare the distribution of Compustat earnings per share for a set of observations matched to the I/B/E/S observations on the basis of year, industry and market capitalization (see Figure 9, panels

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30 Similar differences are observed for comparisons of other profit levels and loss levels.
Panel A compares the distribution of earnings per share for the set of matched observations (the solid line) with the distribution for I/B/E/S observations (the histogram). The matched observations have an earnings per share distribution that is similar to Compustat as a whole (see Figure 1, Panel B). It is evident from a comparison of the distributions for the I/B/E/S sample and the matched sample that analysts tend to avoid coverage of firms that report very small losses and very small gains as the number of matched firms that fall between -$0.15 and +$0.05 cents is observably greater than the number of I/B/E/S firms. Test statistics show the number of I/B/E/S observations is significantly less than the number of matched-firm observations for each one-cent interval from -$0.15 earnings per share to +$0.05 earnings per share (t-statistics for differences at each of these intervals range from 2.43 to 7.08).

Figure 9, Panel B compares the distribution of change in earnings per share for the set of matched observations (the solid line) with the distribution of change in earnings per share for I/B/E/S observations (the histogram). The matched observations have a distribution that is similar to Compustat as a whole (see Figure 4, Panel B). The number of matched firms with very small changes in earnings per share is significantly greater than the number of I/B/E/S firms with very small changes in earnings per (t-statistics for differences in the number of observations between -$0.03 and +$0.03 range from 1.99 to 6.79).

31 Two firms were selected as a possible match for each I/B/E/S firm. Each firm was within the same year and had the same four-digit SIC code. One potential match had the next lower market capitalization, the other the next higher market capitalization. The firm with the smallest difference in market capitalization from the I/B/E/S firm was selected as the match. Although this form of matching seems most defensible, it has the shortcoming that I/B/E/S seems to follow many of the largest firms in each industry classification. The result is that the matching sample is smaller than the I/B/E/S firms with a market capitalization of approximately 84 percent of that of the I/B/E/S firms. The results must be interpreted with this caveat in mind.
6.2 DISTRIBUTION OF I/B/E/S FORECAST ERRORS

The discontinuity in the frequency distribution of analyst forecast errors is often cited in the literature as evidence of earnings management (see, for example, DPZ and Xue [2004]). The frequency distribution for I/B/E/S forecasts errors over the years 1983 to 2002 is shown in Figure 10, Panel A. The figure is very similar to Figure 6 in DPZ. Forecast errors are defined as the difference between I/B/E/S “actual” earnings and the consensus analyst forecast. Thus, in this diagram, firms which have a forecast error equal to zero are firms that have “met” analysts’ forecasts, firms which have a forecast error of $0.01 have “beaten” analyst forecasts by a penny per share, and those that have a forecast error of -$0.01 have “missed” by one penny.

As seen in Figure 10, Panel A, there are more firms that “meet” or “beat” analyst forecasts than firms that “miss”. This figure is, therefore, often interpreted as evidence that firms manage earnings to meet or beat forecasts. In this section we do two things. First we posit an alternative explanation for Figure 10, Panel A. Second, we show that once the alternative explanation is considered, the earnings management explanation becomes implausible.

Our alternative explanation for Figure 10, Panel A, is that the discontinuity in the distribution of analysts’ forecasts is a manifestation of the tendency for analysts to be

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32 We use the I/B/E/S Unadjusted data file (that is, the earnings data has not been adjusted for stock-splits and stock dividends). This ensures that we do not miss-classify firms that in fact missed or beat the forecast as firms that met the forecast (see, Baber and Kang [2002] and Payne and Thomas [2003]).

33 The I/B/E/S manual reports that “actuals” are culled directly from newswires at the time a company reports. Then several checks are done to ensure that “actuals” and forecasts are on the same basis and, if necessary, adjustments are then made to the “actuals”. Most frequently these adjustments are in response to the way analysts treat extraordinary items. They report that most analysts exclude extraordinary items; however, if analysts have included those items, the estimates will also include them. In other words, if analysts’ eliminate some line items in their forecasts, as influenced by “pro forma” earnings issued by managers, those same line items will be eliminated in the I/B/E/S “actual” numbers. Thus any attempted manipulation of forecasts by excluding items from pro forma statements may have no effect on forecast error (I/B/E/S “actual” - I/B/E/S forecast) because I/B/E/S may exclude these items from both its “actual” earnings and its forecast of earnings.
optimistic (see, for example, O’Brien [1993] and Lin [1994]). If the earnings that are reported (I/B/E/S “actual” earnings) are less than the forecast, the forecast is optimistic. If the earnings that are reported are greater than the forecast, the forecast was pessimistic. For example, the difference between actual earnings of $0.50 per share and the analyst forecast $0.51 per share, may be described in two quite different ways (1) the firm, despite possibly managing earnings, missed the forecasted earnings by one cent or, (2) the analyst was optimistic and made an earnings forecast that was a cent higher than earnings turned out to be.

When Figure 10, Panel A, is examined from the point of view of analyst optimism or pessimism, it appears to suggest that analysts tend to be pessimistic much more often than optimistic, contradicting much of the extant literature. We show that this interpretation is incorrect and that the distribution is, in fact, due to analysts’ tendency to be optimistic.

To determine whether analysts are indeed pessimistic, we calculate the median positive forecast error and the median negative forecast error for each cent of earnings per share. The results are shown in Figure 10, Panel B. The line above the x-axis describes the median negative forecast error (that is, “actual” earnings are less than forecast, thus analysts are optimistic) while the line below the x-axis reflects the median positive forecast error (that is, “actual” earnings are greater than forecast earnings, thus analysts are pessimistic). The striking feature of this graph is that the median negative forecast error (analyst optimistic) is, in every instance, greater than the median positive forecast error (analyst pessimistic) supporting the notion that analysts are more optimistic than pessimistic. More importantly, it appears that when analysts are pessimistic, their
median forecast error is, fairly consistently, $0.04, whereas, when they are optimistic, their median forecast error is much larger (at least twice as big).

The fact that analysts, when optimistic, consistently have, on average, at least twice the forecast error they have when they are pessimistic affects the shape of the distribution in Figure 10, Panel A. To illustrate this effect, consider the fact that the median positive forecast error for firms with “actual” earnings of $0.10 is $0.04 and the median negative forecast error is -$0.09 (see Figure 10, Panel B). It follows that observations of positive forecast errors will tend to cluster near zero while observations with negative forecast errors will spread away from zero. Notice also that the median positive forecast error is fairly consistently $0.04, which implies that more than half of the firms with positive forecast errors will fall in the first four positive forecast-error intervals ($0.01, $0.02, $0.03 and $0.04) of Figure 10, Panel A, while firms with the same earnings but with negative forecast errors will be further away from zero.

_A priori_ it seems reasonable to assume that, in the absence of analyst optimism and/or earnings management, we would expect the magnitude of positive forecast errors (for each level of “actual” earnings) to be the same as the magnitude of negative forecast errors. Yet this is not the case. As in the example given above, firms with $0.10 of earnings have, on average, a positive forecast error of $0.04, but a negative forecast error of -$0.09. We would also expect an equal proportion of positive and negative forecast errors. Yet, this is also not the case. Results (not shown) reveal that on average, 64 percent of firms with earnings per share between +$0.01 and +$0.10 have negative forecast errors compared to 36 percent which have positive forecast errors. Fifty-nine
percent of firms with negative earnings between -$0.01 and -$0.10 have negative forecast errors compared to 41 percent which have positive forecast errors.

The observations that negative forecast errors are generally larger than positive forecast errors and there are generally more negative forecast errors is consistent with two explanations (1) when analysts are optimistic their forecast errors are generally greater than when they are pessimistic – in other words, their optimism exacerbates the negative forecast errors and mitigates the positive forecast errors – and they tend to be optimistic more often than they are pessimistic, and/or (2) earnings are managed.

If we assume the patterns of forecast errors shown in Figure 10, Panel B, are caused by earnings management rather than analyst optimism, it must be the case that firms that beat analyst forecasts pervasively manage earnings downward in such a way that they beat by a relatively small amount. At the same time firms that miss the analyst forecast must also be pervasively managing their earnings downward to miss by a large amount. The latter explanation (managing downward) does not seem plausible to us. Furthermore, this explanation is at odds with the premise in the literature that examines management of earnings to meet the forecast. The premise is that firms manage earnings upward to meet or beat the zero-earnings surprise threshold.

In summary, the weight of evidence described in this section suggests that the discontinuity in the distribution of analysts’ forecast errors is due to analysts’ optimism

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34 The earnings management argument would run as follows. When firms see that they are not going to meet the forecast, they engage in “big-bath” behavior and/or they encourage the optimism in the analysts. Conversely, when firms see that they are going to beat the forecast, they manage earnings downward, possibly creating a reserve for a future time when they may wish to manage earnings upward. Inter alia, the pervasiveness of the difference between the magnitude of optimistic forecasts and the magnitude of pessimistic forecasts at each cent interval for both profit and loss firms suggests that this behavior is unlikely.
rather than due to a tendency to manage earnings upward to meet or beat analysts’ forecasts.

7. **Summary and conclusions**

We have shown that, in contrast to the frequency distribution of net income deflated by lagged market capitalization, total assets, or sales revenue, the frequency distribution of reported earnings *per share* does not show a discontinuity at zero. In fact, there are more firms that report a one-cent per share loss than a one-cent per share profit with a peak in the frequency distribution at zero cents. This suggests that the discontinuity observed in prior studies may be due to deflation rather than the properties of earnings *per se*. To explore this possibility, we provide evidence of significant pricing differences between firms that report positive earnings and firms that report losses.

The basic premise (and, often, the maintained hypothesis) in the growing literature that focuses on the discontinuity in the distribution of deflated earnings at zero is that the discontinuity is evidence of earnings management to avoid losses. Our evidence suggests that the discontinuity may be due to differential pricing of small losses and small profits which leads to a relatively larger deflator for profits compared with that for losses.

Similarly, the discontinuity at zero in the frequency distribution of change in net income deflated by beginning-of-period market capitalization is not evident in the distribution of change in earnings per share. This is not surprising in view of the high correlation between earnings per share and change in earnings per share.
We also show that the previously observed discontinuity in I/B/E/S “actual” earnings is largely a result of the fact that only a very small proportion of the firms that report small losses or small profits are followed by I/B/E/S and that I/B/E/S follows a much smaller proportion of stocks that have small losses than stocks that have small profits. This evidence suggests that the discontinuity in the distribution of I/B/E/S “actual” earnings and change in I/B/E/S “actual” earnings at zero is likely due to the selection of firms followed by I/B/E/S rather than evidence of earnings management.

Finally, we examine the discontinuity in the distribution of analyst forecast errors, which is also often seen as evidence that firms manage earnings to meet or beat analyst forecasts. We reinterpret the same evidence in the context of analyst optimism: that is, an optimistic forecast results in a negative forecast error while a pessimistic forecast results in a positive forecast error. We then show that the magnitude of analysts’ optimism is greater at each level of earnings than the magnitude of analysts’ pessimism and we show how this difference in the magnitude of forecast errors will place firms that beat the analyst forecast closer to the meet/beat threshold, while pushing firms that miss farther from that threshold.

Our results have important implications for studies that rely on the discontinuity in the frequency distribution of earnings, change in earnings, I/B/E/S “actual” earnings, or forecast errors as evidence of earnings management. We show that there are very plausible explanations other than earnings management for these discontinuities. Therefore, caution should be taken when interpreting the discontinuities as evidence of earnings management to exceed a zero threshold.
REFERENCES


FIG. 1. --Panel A: Frequency distribution of net income deflated by market capitalization.

Panel B: Frequency distribution of reported earnings per share.
FIG. 1. -- Compares the frequency distributions of deflated net income and undeflated earnings per share. Panel A is a replication of the BD, figure 3 using data from 1983 to 2002. The figure shows 81,590 of the 98,947 observations for which data required in the calculation of annual net income deflated by beginning-of-year market capitalization (fiscal year-end price is item #199, shares outstanding is item #25 and net income is item #172) are available on the 2002 Compustat Annual Industrial files. As in BD, the distribution interval width is 0.005. The first interval to the right of zero contains observations in the interval > 0.00 to \leq 0.005 and the first interval to the left of zero contains observations in the interval < 0.00 to \geq -0.005. The point where net income/market capitalization is zero is marked as 0.00. Panel B is the frequency distribution of fully diluted earnings per share by one-cent intervals for the 84,908 observations with earnings per share between -$1.00 and +$1.00 on the Compustat Annual Industrial file (34 percent of the observations of earnings per share on the Compustat file lie outside of this range).
FIG. 2. -- Panel A: Frequency distribution of earnings per share for observations in the Compustat 2002 Annual file which have beginning-of-year price on the file.

Panel B: Frequency distribution of earnings per share for observations that do not have prior year’s fiscal year-end price in the Compustat 2002 Annual file.
FIG. 2.—Compares the frequency distributions of earnings per share for firms with beginning-of-year price available on Compustat to the frequency distribution of earnings per share for firms without a beginning-of-year price. Panel A is the frequency distribution of earnings per share for observations for which beginning-of-year price is available on the Compustat annual file. The panel shows 62,412 observations with earnings per share (item #57) between -$1.00 and +$1.00 for which beginning-of-year price (item #199) is available on the 2002 Compustat Annual Industrial files (36 percent of the observations lie outside of this range). Panel B is the frequency distribution of the 22,496 observations of earnings per share between -$1.00 and $1.00 for which beginning-of-year price is not available (29 percent of the observations lie outside this range).
FIG. 3. -- Panel A: Frequency distribution of net income for all observations.

Panel B: Frequency distribution of net income for the sub-sample of observations that have beginning-of-year price available on the 2002 Compustat file
FIG. 3. – Compares the frequency distributions of net income for all firms on the 2002 Compustat Annual Industrial File with the sub-sample that has beginning-of-year price available on the file. Panel A is the frequency distribution of net income (item #172) for the 78,892 observations with net income between -$5 million and $7 million (42 percent of the observations lie outside of this range). Panel B is the frequency distribution of net income for the 50,570 observations that have beginning-of-year price (item #199) on the file (49 percent of the observations lie outside of this range). Intervals are $100,000 wide.
FIG. 4. -- Panel A: Frequency distribution of change in net income deflated by market capitalization.

Panel B: Frequency distribution of change in earnings per share.
FIG. 4. – Compares the frequency distribution of deflated change in net income to undeflated change in earnings per share. Panel A replicates BD figure 1 using data from the 2002 Compustat Annual Industrial file. It is the distribution of changes in annual net income (item #172) deflated by beginning of the year market capitalization (item #199 times item #25). The distribution interval width is 0.0025. The first interval to the right of zero contains observations in the interval > 0.0000 to ≤ 0.0025 and the first interval to the left of zero contains observations in the interval < 0.0000 to ≥ -0.0025. The point where change in net income/market capitalization is zero is marked as 0.00. The figure shows 61,690 with deflated change in net income between -0.15 and +0.15 (27 percent of the observations lie outside of this range). Panel B is the histogram of changes in reported diluted earnings per share – item #57 (shaded), contrasted with change in earnings per share adjusted for inflation -- CPI adjusted changes in eps (the solid line). The source of the CPI adjustment is the consumer price index taken from the 2004 Economic Report of the President, Table B-64, percent changes in consumer price index, year to year. The histogram of unadjusted (nominal) changes in reported diluted earnings per share includes 88,768 observations of the 112,258 observations available which have earnings per share (item #57), current and lagged, and the adjustment factor (item #27), current and lagged.
FIG. 5. -- Panel A: Frequency distribution of net income deflated by beginning-of-year market capitalization for observations with reported earnings per share between -$0.01 and $0.01 inclusive.

Panel B: Frequency distribution of beginning-of-year prices for observations with reported earnings per share between -$0.01 and $0.01, inclusive.
Panel C. Frequency distribution of net income deflated by market capitalization for observations which report net income between -$100,000 and $100,000.

Panel D. The frequency distribution of market capitalization for observations with net income between -$100,000 and $100,000.
FIG. 5. – Examines both firms that report very small earnings per share (-$0.01 to +$0.01) and firms that report very small net income (-$100,000 to +$100,000). Panel A is a replication of BD figure 3, for only firms which report -$0.01, $0 or +$0.01 earnings per share. This panel shows 3,198 of the 3,248 observations for which data required in the calculation of annual net income deflated by beginning-of-year market capitalization (fiscal year-end price is item #199, shares outstanding is item #25 and net income is item #172) are available on the 2002 Compustat Annual Industrial files. As in BD, the distribution interval width is 0.005 wide. The first interval to the right of zero contains observations in the interval >0.00 to \( \leq 0.005 \) and the first interval to the left of zero contains observations in the interval <0.00 to \( \geq -0.005 \). Panel B is the frequency distribution of beginning-of-year prices by ten cent intervals for the 3,316 observations with earnings per share between -$0.01 and +$0.01 on the Compustat Annual Industrial file, and price per share between $0.00 and $3.00 (1 percent of the observations have prices greater than $3.00). Firms which report positive net income are separated from those which report negative net income. Panel C is a replication of BD figure 3 for only firms which report net income between -$100,000 and +$100,000. This panel shows 2,650 of the 2,790 observations for which data required in the calculation of annual net income deflated by beginning-of-year market capitalization are available on the 2002 Compustat Annual Industrial files. As in BD the distribution interval width is 0.005 wide. The first interval to the right of zero contains observations in the interval >0.00 to \( \leq 0.005 \) and the first interval to the left of zero contains observations in the interval <0.00 to \( \geq -0.005 \). Panel D is the frequency distribution of market capitalization (interval widths are $1 million), for the 2,886 observations with net income between -$100,000 and +$100,000 on the 2002 Compustat Annual Industrial file (2 percent of the observations have market capitalization greater than $43 million).
FIG. 6. – Distribution of beginning-of-year price.

FIG. 6. – Shows the distribution of beginning of the year price for each one-cent earnings per share interval. It reports percentiles (5th, 25th, 50th, 75th and 95th) of lagged price for each one-cent earnings per share interval. The mean is computed after deleting the top 1 percent of observations. The figure shows 62,412 observations with earnings per share (item #57) between -$1.00 and +$1.00 for which beginning-of-year price (item #199) is available on the 2002 Compustat Annual Industrial files (36 percent of the observations lie outside the range shown).
FIG. 7. — Panel A: Frequency distribution of “actual” earnings per share for observations followed by I/B/E/S.

Panel B. Distribution of change in earnings per share for observations followed by I/B/E/S.
FIG. 7. – Shows the distribution of I/B/E/S “actual” earnings per share and change in “actual” earnings per share for firms followed by I/B/E/S between 1983 and 2002. Panel A is the frequency distribution of I/B/E/S “actual” earnings per share for the 31,741 observations which have an “actual” earnings per share that falls between -$1.00 and +$1.00 (52 percent of the observations lie outside this range). Panel B is the frequency distribution of the 44,267 changes in earnings per share for firms which had “actual” earnings (current and lagged) between -$1.00 and +$1.00 on the I/B/E/S files (17 percent of observations had changes in earnings per share outside this range).
FIG. 8. -- Panel A: Proportion of Compustat observations followed by I/B/E/S, by earnings per share.

Panel B: Proportion of Compustat observations followed by I/B/E/S classified by change in earnings per share.
FIG. 8. – Shows the proportion of Compustat firms followed by I/B/E/S classified by cent per share intervals and change in cent per share intervals. Panel A is the proportion of Compustat firms followed by I/B/E/S for each earnings per share interval between -$1.00 and +$1.00 for which earnings per share are available (item #57 or #58 depending on whether the I/B/E/S actual earnings are flagged as primary (basic) or diluted). 57 percent of Compustat firms and 58 percent of I/B/E/S firms fell outside the intervals shown. Panel B is the proportion of Compustat firms followed by I/B/E/S for each one-cent earnings change interval between -$1.00 change and +$1.00 change for which prior year earnings per share are available. 61 percent of the Compustat firms and 39 percent of the I/B/E/S firms fall outside the range shown.
FIG. 9. – Panel A: Frequency distribution of earnings per share for I/B/E/S and matching firms

Panel B: Frequency distribution of changes in earnings per share for I/B/E/S and matching firms.
FIG. 9. – Is the frequency distribution of Compustat earnings per share for I/B/E/S firms and a set of matching firms taken from the 2002 Compustat Annual Industrial File. Firms are matched based on year, 4-digit SIC code, and by nearest market capitalization. Panel A (histogram) shows 27,544 of the observations from I/B/E/S for which earnings per share are between -$1.00 and +$1.00 (60 percent of the I/B/E/S firms which had Compustat matches fall outside the range shown). The solid line shows 29,311 of the Compustat firms which were matched to I/B/E/S and had earnings per share between -$1.00 and +$1.00 (58 percent of the matched firms fall outside this range). Panel B (histogram) shows 40,480 of the observations from I/B/E/S for which change in earnings per share are between -$1.00 and +$1.00 (58 percent of the I/B/E/S firms which had Compustat matches fall outside the range shown). The solid line shows 39,984 of the Compustat firms which were matched to I/B/E/S and had change in earnings per share between -$1.00 and +$1.00 (58 percent of the Compustat matching firms fall outside this range).
FIG. 10. -- Panel A: Frequency distribution of analyst forecast error.

Panel B. Median positive and median negative forecast error for each one-cent I/B/E/S “actual” earnings.
FIG. 10 – Shows the frequency distribution of analysts’ forecast errors (I/B/E/S “actual” – I/B/E/S forecast) and the median positive and negative forecast errors. Panel A, is the frequency distribution of analysts’ forecast errors (I/B/E/S “actual” earnings minus mean I/B/E/S forecasts) for the 63,695 observations which have analysts’ forecast errors between -$1.00 and +$1.00 and have both I/B/E/S “actual” earnings I/B/E/S forecasts available between 1983 and 2002 (4 percent of the observations lie outside the range shown). Panel B, splits the median forecast error between negative and positive errors at each one-cent interval of earnings per share. Observations with zero forecast error are not shown. Signs were switched so that negative forecast errors are above the x-axis. This panel shows 24,883 observations with earnings per share between -$1.00 and +$1.00 for which I/B/E/S actual and I/B/E/S mean forecast are available (55 percent of the observations lie outside the range shown).
Table 1.
The difference between price per share associated with losses and price per share associated with profits of the same amount per share

<table>
<thead>
<tr>
<th>Reported earnings per share</th>
<th>Profits Mean</th>
<th>Profits Median</th>
<th>Losses Mean</th>
<th>Losses Median</th>
<th>t-statistics for the difference in price between profit and loss observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/- $0.01</td>
<td>3.10</td>
<td>1.31</td>
<td>1.54</td>
<td>0.25</td>
<td>4.88 9.34</td>
</tr>
<tr>
<td>+/- $0.02</td>
<td>3.29</td>
<td>1.63</td>
<td>1.96</td>
<td>0.38</td>
<td>4.93 7.69</td>
</tr>
<tr>
<td>+/- $0.03</td>
<td>3.73</td>
<td>1.69</td>
<td>2.37</td>
<td>0.53</td>
<td>4.04 8.20</td>
</tr>
<tr>
<td>+/- $0.04 to $1.00</td>
<td>10.97</td>
<td>8.06</td>
<td>4.44</td>
<td>2.00</td>
<td>30.13 28.89</td>
</tr>
</tbody>
</table>

Table 1. Differences in means and medians are estimated for each of the 20 years of annual cross-section data. t-statistics equal the ratio of the average differences to their standard errors. Price is beginning-of-year price (Compustat item #199), earnings per share is Compustat item #57. There are 80,503 observations between -$1.00 and +$1.00. Mean prices are calculated after deleting the highest one percent of price at each cent interval.
Table 2.
The difference between total assets per share associated with losses and total assets per share associated with profits of the same amount per share

<table>
<thead>
<tr>
<th>Reported earnings per share</th>
<th>Profits</th>
<th>Losses</th>
<th>t-statistics for the difference in total assets between profit and loss observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>+/- $0.01</td>
<td>4.27</td>
<td>0.99</td>
<td>1.78</td>
</tr>
<tr>
<td>+/- $0.02</td>
<td>5.20</td>
<td>1.25</td>
<td>2.49</td>
</tr>
<tr>
<td>+/- $0.03</td>
<td>5.54</td>
<td>1.76</td>
<td>3.15</td>
</tr>
<tr>
<td>+/- $0.04 to $1.00</td>
<td>17.13</td>
<td>8.52</td>
<td>7.11</td>
</tr>
</tbody>
</table>

Table 2. Differences in means and medians are estimated for each of the 20 years of annual cross-section data. t-statistics equal the ratio of the average differences to their standard errors. Total assets is beginning-of-year total assets per share (Compustat item #6 divided by Compustat item #25), earnings per share is Compustat item #57. There are 70,655 observations between -$1.00 and +$1.00. Mean total assets per share is calculated after deleting the highest one percent of observations at each cent interval.