Intra-year shifts in the earnings distribution and implications for earnings management*

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Abstract
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JEL Classification: M4; L14; C89

Keywords: Earnings management; Earnings distribution; Losses

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1. Introduction

Generally accepted accounting principles allow managers discretion within the financial accounting framework for reporting earnings to enhance the usefulness of financial statements. Managers can misuse this discretion. Motivated by opportunity to enhance compensation or mitigate violations of debt covenants that protect lenders, they can manage earnings.¹ Prior research examines whether firms use earnings management to attain certain earnings benchmarks (e.g., profitability, earnings increases, and analysts’ forecasts). Studies have also examined earnings management tendencies over time.²

In a seminal paper, Burgstahler and Dichev (1997, henceforth, BD) build on results of Hayn (1995) to show that there is a large kink in the annual earnings distribution around zero resulting from abnormally low frequencies of firms with small losses and abnormally high frequencies of firms with small profits.³ Degeorge et al. (1999) find similar evidence involving quarterly earnings distributions. From the kink in the distribution of annual earnings around zero profit line, BD and Hayn infer that the kink is evidence of firms avoiding smallest losses and attaining smallest profits through upward earnings management (henceforth referred to as “BD/Hayn methodology”). Hayn (1995) notes:

The frequency of observations in both the region just above and that just below departs significantly from the expected frequency under the normal distribution at the 1% significance level using the binomial test. These results suggest that firms whose earnings

¹ For an excellent review of earnings management literature, refer to Healy and Whalen (1999).
² For an examination of earnings management tendencies over time, see Brown, 2001; Bartov et al., 2002; Lopez and Rees, 2002; Matsumoto, 2002; and, Brown and Caylor, 2005.
³ The kink in this work refers to the discontinuity in an earnings distribution, specifically the unusually low (high) frequency in the smallest loss (profit) interval of earnings distribution. This definition applies to distributions of annual earnings as well as year-to-date earnings at the end of the third fiscal quarter.
are expected to fall just below the zero earnings point engage in earnings manipulations to help them cross the ‘red line’ for the year. (p 132, italics added)

Likewise, BD argue that:

Similarly, (earnings) management to avoid losses will be reflected (in cross-sectional distributions of earnings) in the form of unusually low frequencies of small losses and unusually high frequencies of small positive earnings. (p 102, italics added)

Additionally, under the assumption of a smooth annual earnings distribution, BD estimate that up to 44% of firms facing small losses manage earnings to achieve small profits.

The main advantage of using BD/Hayn’s methodology of inferring earnings management from cross-sectional distribution of earnings is that of avoiding omitted correlated variables problems inherent in measures of discretionary accruals (McNichols, 2000). Nevertheless, there are several reasons to extend BD and Hayn’s research. To properly test the BD/Hayn hypothesis, one needs the distribution of pre-managed earnings. Since pre-managed earnings cannot be observed, or calculated reliably, alternative methods are needed to investigate earnings management from the shape of the cross-section of earnings distribution. BD/Hayn focus only a static picture of earnings at the end of the year and, thus, cannot explain how the kink evolved from an earlier earnings distribution during the year to the one containing the kink. It would be natural, for example, to make a comparison between year-to-date third quarter earnings and annual earnings. Since the fourth quarter represents a manager’s last opportunity during the year to manage annual earnings, then analyzing changes in the earnings distributions between the third and fourth quarters can yield insights into how managers use this opportunity. If the kink
gets more pronounced during the fourth quarter, then this suggests that there were abnormal earnings shifts resulting from earnings management during that quarter.

The fact that BD find such a large number of firms manipulating earnings upwards to report small reporting is surprising and raises questions about the accuracy of their inferences drawn solely from the annual earnings distribution. According to Staff Accounting Bulletin No. 99, the SEC considers material any earnings management that converts losses into profits, triggers bonus, or crosses performance thresholds for other covenants even if the dollar amount is small. Auditors are expected to be watchful for this possibility and should prevent managers from misusing their discretion in order to convert small losses into small profits. BD’s results suggest that auditors, who are required to act as gatekeepers against such earnings management transgressions to protect creditors and investors, are failing at an alarmingly high rate. Their results imply that there are systematic weaknesses in the overall controls necessary to maintain the integrity of financial statements.

Other research has raised questions about BD/Hayn’s explanation of the kink. Dechow et al. (2003) find that firms having both small profits and small losses have large positive discretionary accruals. Durtschi and Easton (2005) point out that several factors affect the shape of earnings distribution around zero, including deflation by price. They conclude that the shape of earnings distribution cannot be used as ipso facto evidence of earnings management.

In this paper, our main objective is to provide evidence of earnings management by identifying firms that report the smallest annual profits as a result of abnormal interval shifts within the earnings distribution during the fourth quarter. For reasons discussed later, we

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4 Although examination of Durtschi and Easton (2005)’s result is beyond the scope of our study, it is worthwhile to point out that in our study, we do not find scaling by price to be factor in explaining the kink. Both mean and median sizes of firms with the smallest annual losses are greater than the same for firms with the smallest annual profits.
consider two possible abnormal earnings interval shifts during the fourth quarter that can lead to a high frequency of firms reporting smallest annual profits. The first is that an abnormal number of firms shifted from the smallest loss interval of year-to-date earnings after three quarters to the smallest profit interval at the end of the year. The second is that firms in the smallest profit interval abnormally remained in that interval during the fourth quarter.

To model normal shifts, we use a control group consisting of firms with year-to-date earnings after three quarters near the smallest loss or smallest profit region. We expect that in the absence of earnings management, firms that are in close proximity to each other in the earnings distribution after three quarters have a similar probability of shifting intervals during the fourth quarter. We control for risk (size and market to book value ratios), industry and years to model normal shifts.

Our approach extends BD/Hayn methodology without directly estimating the pre-managed earnings distribution. Our results are consistent with BD/Hayn’s original conclusions that earnings management is used to avoid smallest losses and achieve smallest profits. We find that firms with the smallest profits at the end of the third quarter report the smallest annual profits at an abnormally high rate. At the same time, these same firms abnormally avoid shifting into the smallest annual loss interval. These two results together suggest that managers avoided smallest losses and achieved smallest profits using upward earnings management. Firms having smallest losses after three quarters, on the other hand, exhibit no abnormal movement into the smallest profit interval but are more likely to experience further losses. Collectively, these results suggest that auditors are particularly vigilant in preventing firms with small losses from moving into the smallest annual profit interval during the fourth quarter. On the other hand, auditors do not
appear to be as concerned that firms may be under-reporting fourth quarter losses by putting on
the ‘brakes’ just enough to avoid entering into the smallest annual loss region.

The rest of the paper proceeds as follows. Section 2 examines the use of earnings
distribution to infer earnings management and develops hypotheses of loss avoidance in the
context of original loss avoidance hypothesis of BD/Hayn. Section 3 describes data,
methodology, empirical results and sensitivity analyses. Section 4 concludes.

2. Testing loss avoidance hypothesis

Prior literature, including BD, Hayn (1995) and Degeorge et al (1999), concludes that
managers try to beat certain earnings targets by manipulating earnings. The basis for their
conclusions is the existence of a kink in distributions of earning at the target line i.e., the
frequency of firms is higher than expected just to the right of the target line, and lower than
expected just to the left of the target line. Degeorge et al suggest that the most important targets
for managers, in order, are achieving (1) profitability; (2) year-to-year earnings increases and (3)
earnings forecasted by analysts.

Of the three targets, we focus on the avoidance of small losses.5 In a recent paper, Brown
and Caylor (2005) suggest that the pecking order described in Degeorge et al. may have
changed.6 They find the propensity of firms to avoid earnings surprise has increased. However,
they also report that the propensity to avoid losses has not decreased over time.

As discussed previously, the earnings management inferred by BD/Hayn from the kink in
the annual earnings distribution is difficult to verify without observing or reliably calculating
pre-managed earnings. The commonly used procedure of estimating discretionary accruals as a

6 A survey of financial executives conducted by Graham et al. (2005) suggests that reporting an increase in quarterly
earnings is the most important target for the managers. However, Brown and Caylor (2005) find that reporting
earnings better than analysts’ forecast is the most important threshold.
proxy for managed component of earnings has the inherent econometric problem of correlated
omitted variables. Recent evidence provided by Graham et al (2005) and Roychadhury (2005)
suggests that firm can manipulate reported earnings not only by accruals, but also by
manipulating economic activities affecting cash flows. If firms can manipulate accruals as well
as cash flows to manipulate earnings, then approaches that require dichotomizing earnings into
its managed component and non-managed component must divide accruals as well as cash flows
into their respective discretionary and non-discretionary components and consider the joint use
of both discretionary cash flows and accruals.

In the absence of a reliable way to construct the distribution of pre-managed annual earnings,
we examine abnormal shifts in the earnings distribution during the fourth quarter into the
smallest annual profits interval. The distribution of year to date earnings at the end of the third
quarter is not expected to act as a proxy for pre-managed annual earnings, but a comparison of
this distribution to the annual earnings distribution can be instructive. Since the fourth quarter
represents a manager’s last opportunity during the year to manage annual earnings, then
analyzing changes in the earnings distributions between the third and fourth quarters can yield
insights into how managers use this opportunity. If the kink gets more pronounced during the
fourth quarter, then this suggests that there are abnormal earnings shifts that result from
managers converting smallest pre-managed annual losses into smallest annual profits.

Firms can theoretically take multiple abnormal paths in the fourth quarter to end up with
smallest profits, but we consider the two paths that involve the least amount of movement from
the year-to-date third quarter earnings distribution. Our assumption is that these firms face the
lowest costs of earnings management. The first path that we consider is that firms move
abnormally one interval over from the smallest loss interval after three quarters into the smallest
profit interval during the fourth quarter. This implies a ‘causal’ relationship between a fourth quarter decline in the smallest loss interval and a fourth quarter increase in the smallest profit interval. The second possible path is that firms remain abnormally in the smallest profit interval. We formally propose these two possibilities as testable hypotheses of loss avoidance, stated in alternate form:

The first hypothesis of loss avoidance (H1a): *Firms convert the smallest year-to-date three quarter losses into the smallest annual profits.*

The second hypothesis of loss avoidance (H2a): *Firms prevent the smallest year-to-date three quarter profits from turning into the smallest annual losses.*

### 3. Results

#### 3.1 Data description

We use all available data from annual as well as quarterly industrial and research Compustat databases from years 1976-2004. We provide separate analyses for the period 1976-1994, the same period as in BD. As in BD, we (1) delete banks, financial institutions and firms in regulated industries; (2) focus on net income (annual data item 172) and scale it by total market value of equity at the beginning of the year; and (3) delete firms with net income exactly equal to zero. Degeorge et al. (1999), and Durtschi and Easton (2005) have criticized scaling since it can result in spurious concentration of observations around zero due to rounding-off, spurious concentration of observations around zero due to rounding-off, and possibly due to coding errors.

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7 Alternatively, if the smallest loss firms do not shift abnormally into the smallest profit interval, it may be due to year-end auditors being vigilant against upward earnings management.

8 See BD footnote 9 (p 108). In comparison to 25 firms deleted by BD, we deleted 36 firms that have exactly zero annual net income. We also deleted 68 firms with year-to-date third quarter earnings exactly equal to zero. BD argued that firms with earnings exactly equal to zero are likely to be due to coding errors. These firms also pose a problem as to whether they should be included in the small loss group or small profit group. Nonetheless, the number of such firms is very small and unlikely to overturn overall conclusions of the paper.
although the alternative of not scaling can introduce a heterogeneity problem in the research
design.  

Definitions of all accounting variables in the analysis follow:

\[ MV \]  
\[ = \text{beginning of the year market value of equity} \]
\[ = \text{Annual Compustat item # 25 x item # 199} \]

*Earnings metrics:*

\[ NI \]  
\[ = \text{Annual earnings} \]
\[ = \text{Compustat annual item #172/MV} \]

\[ \text{YTDQ3} \]  
\[ = \text{Year-to-date earnings of the first 3 quarters/MV} \]
\[ = \sum_{n=1}^{3} [\text{Quarterly Compustat item#69:Qn}] / MV \]

*Other variables:*

\[ \text{BM} \]  
\[ = \text{Book-to-market value at the beginning of the year} \]
\[ = \text{Compustat annual (item#216)/MV} \]

\[ \text{SIZE} \]  
\[ = \text{Log(MV)} \]

\[ \text{IND}_i \]  
\[ = \text{Industry dummy variable based on two-digit SIC code } i \text{ of a firm’s industry} \]

\[ \text{YR}_j \]  
\[ = \text{Year dummy variable based on fiscal year of the observation.} \]

We form intervals of each earning metric with a width of 0.005, the same as the interval
width in BD, which ensures that all intra-year earnings interval movements involve standard
distances. We label the smallest profit (loss) interval +1(−1). Intervals +2, +3, +4, etc.
(−2, −3, −4 etc.) are the successive intervals to the right (left) of the smallest profit (loss) interval
in an earnings distribution. To be included in our sample, a firm must have data for all variables

\[ \text{See footnote 5.} \]
that are defined above. The sample consists of 67,051 observations from the 1976 to 1994 period, while BD reports a sample of 75,999 (p 104) for the same period. The difference is due to our research design requiring the first three quarters of Compustat earnings information along with Compustat annual earnings information for each fiscal year.\textsuperscript{10} For 1995-2004, the number of observations with required data availability is 54,816.

Table 1, Panel A, reports the distribution of the annual earnings variable for the period 1976-1994. The mean annual earnings is 0.013 which compares with the value reported in BD for this period (Table 1, Panel B, page 104). In Panel B, we report data for the post-BD period, i.e., 1995 to 2004. The 1995-2004 period has more observations per year, and annual earnings are generally lower. The mean value of annual earnings variable is $-0.111$. As in BD, the number of observations rises steadily over time and the median value is always greater than the mean value suggesting extreme negative values.

### 3.2 Kinks in annual earnings and year-to-date earnings after three quarters

We plot a histogram of scaled earnings with histogram interval widths of .005 for the range $-0.15$ to $+0.15$. The graph of Figure 1a (2a) provides the histogram of scaled annual earnings, NI, for the period 1976 to 1994 (1995 to 2004) in our sample, and the graph of Figure 1b (2b) provides histogram of year-to-date scaled earnings of the first three quarters, YTDQ3, for the same period. The graph of annual earnings visually confirms the shape of the earnings distribution reported in BD with the kink around zero (Figure 3, p 109). This suggests that the loss in data from the restrictions above does not alter the main result of BD. Under the assumption that the earnings distribution is smooth, earnings slightly less than zero occur less frequently than expected, while earnings slightly more than zero occur more frequently than

\textsuperscript{10} We did not include firms that have had fewer than four quarters of earnings activity since these firms may not face the same pressure to achieve fiscal year profits as managers with a full year of operations.
expected. We use the same test statistic as BD (p 103 and footnote 6). It represents the difference between the actual frequency in an interval and the expected frequency in that interval divided by the standard deviation of the difference. Let $N$ be the total number of observations and $p_i$ be the probability that an observation will fall into interval $i$, then the variance of the difference is:

$$Var = N \cdot p_i (1 - p_i) + (1/4)N \cdot (p_{i-1} + p_{i+1}) \cdot (1 - p_{i-1} - p_{i+1}).$$

(1)

The standardized difference, $Z$, is defined as follows:

$$Z = \frac{n - E(n)}{\sqrt{Var}},$$

(2)

where $n$ is the actual frequency in the interval being analyzed and $E(n)$ is the expected frequency. Under the assumption of smoothness, the expected frequency in an interval is the average of the numbers in the two adjacent intervals.

The test statistic confirms the irregularity in the distribution of annual earnings. The standardized difference between the observed frequency and the expected frequency of firms reporting earnings slightly more (less) than zero is $Z = 9.39$ ($Z = -14.05$). Under the assumption that the test statistic is distributed approximately normal, these results are similar to results reported in BD, Dechow et al. (2003) and Degeorge et al. (1999).

An analysis of scaled annual earnings data for the period 1995-2004, depicted in the graph of Figure 2a, also shows a kink. Using the same tests as above, the standardized difference between the observed frequency and the expected frequency of firms reporting earnings slightly more (less) than zero is $Z = 5.27$ ($Z = -7.14$).

Figures 1(b) and 2(b), which depict the YTDQ3 distributions, show that the kink is visually less pronounced in the third quarter than it is after the fourth quarter in, both periods. Statistical tests, similar to tests for annual earnings described above, confirm these observations.
3.3 Evidence of loss avoidance from earnings interval shifts around the kink during the fourth quarter

We examine the change in the shape of the kink during the fourth quarter by calculating the percentage change in frequencies of the smallest loss and the smallest profit intervals. Results of Table 2 show that the mean (standard deviation) of the percentage change in the frequency of intervals -5 to +5 from 1976-1994 is -35.75% (13.02%), and during the 1995-2004 period is -32.25% (6.46%). For 1976-1994 period, the standardized change in the frequency of -1 interval is -5.36, and for + interval the standardized change is +4.95, which are significant at 0.1% level. For 1995-2004 period, the standardized change for is -1 interval is -5.16 and for +1 interval, it is +5.20. Both are significant at 0.1% level. A simultaneous decrease in -1 interval, and increase in +1 interval causes the kink to appear more exaggerated in the distribution of annual earnings, in comparison to the distribution of YTDQ3, supporting the visual evidence from comparing the graphs of Figures 1 and 2.

Given the significant changes of -1 and +1 intervals during the fourth quarter, we consider whether the percentage shifts (X) in these intervals during the fourth quarter over the paths stated in our hypotheses are abnormal relative to equivalent shifts by neighboring intervals. To measure abnormal shifts, we examine percentage shifts relative to an equivalent shift over the same distance and direction by firms in control groups (Y) as follows:

\[ Y = \text{relative shift} = X - \text{equivalent shift by control groups}. \]

We calculate Y for four control groups labeled CG2, CG3, CG4 and CG5, where control group CGn includes firms in YTDQ3 intervals −2 to −n and +2 to +n. For example, control group CG3 includes firms in intervals −2, −3, +2 and +3.\textsuperscript{11} Control groups include intervals that are

\textsuperscript{11} Control groups do not include interval -1 or +1 to avoid endogeneity problems.
further away from the kink as the value of $n$ increases. An equivalent shift of the control group involves movements over the same interval length and direction as that of $X$.

Table 3 reports values of $X$, $Y$, and t-statistics for the following three paths: from interval $-1$ of YTDQ3 to $+1$ of NI, from $+1$ of YTDQ3 to $+1$ of NI and from $+1$ of YTDQ3 to $-1$ of NI. For the shift from $-1$ interval to $+1$ interval, the test of relative shift ($Y > 0$) examines whether firms with the smallest YTDQ3 losses report smallest annual profits at a significantly higher rate. For both periods and for every control group, we find no evidence to support the first hypothesis of loss avoidance (H1a) that firms shifted abnormally from $-1$ to $+1$. For the shift from $+1$ interval to $+1$ interval, the test of $Y > 0$ examines whether firms with the smallest YTDQ3 profits report the smallest annual profit at a significantly higher rate. For both periods and for every control group, the smallest YTDQ3 firms abnormally remained in the smallest annual profit interval, which supports the second hypothesis of loss avoidance (H2a). For the shift from $+1$ interval to $-1$ interval, the test of $Y < 0$ examines whether firms with the smallest YTDQ3 profits report the smallest annual losses at a significantly lower rate. For the period 1976-1994, and for every control group, the smallest YTDQ3 profit firms reported the smallest annual losses at a significantly lower rate, which supports the second hypothesis of loss avoidance. For the period 1995-2004, the support for hypothesis H2a tends to weaken as control groups move further away from the kink, i.e., it is supported at the 1% level for CG2, at the 5% level for CG3, at the 10% level for CG4, and is not supported for CG5.

3.4 Logistic regression to examine loss avoidance hypotheses

We further test loss avoidance hypotheses, H1a and H2, using logistic regression models, where we control for risk (size and book-value), industry and years. These models examine the
same earnings interval paths described in Table 3 for the BD (1976-1994) and post-BD period (1995-2004).

\[
\log(\frac{it}{1-it}) = \alpha + \beta_1 DUM_k + \beta_2 SIZE + \beta_3 BM + \sum_{i} \gamma_i IND_i + \sum_{j} \eta_j YR_j + \varepsilon \quad (3.k)
\]

Subscript \( k \) assumes a distinct value for each path examined and results in a different logistic model, with different sample firms, different \( Y_k \), the response variable, and different \( p_k \), the probability that response variable \( Y_k = 1 \). Variables SIZE, BM, IND and YR are as defined previously. We use CG2, consisting of firms in the –2 and +2 intervals after three quarters, as the control group assuming that firms closest to those in the –1 and +1 intervals represent the best proxy for the expected movements of the treatment group, i.e., intervals –1 and +1 respectively. Each logistic regression model is as follows:

<table>
<thead>
<tr>
<th>( k )</th>
<th>Logistic Equation (3.k)</th>
<th>Applicable hypothesis</th>
<th>Sample Firms</th>
<th>( Y_k = 1 ) if sample firms: ( (Y_k = 0 ) otherwise)</th>
<th>DUM(_k) = 1 if firms belong to: ( (DUM(_k) = 0 ) otherwise)</th>
<th>Results described in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(3.1)</td>
<td>H1a</td>
<td>CG2 and interval –1 of YTDQ3</td>
<td>moved up one interval</td>
<td>interval –1 of YTDQ3</td>
<td>Table 4</td>
</tr>
<tr>
<td>2</td>
<td>(3.2)</td>
<td>H2a</td>
<td>CG2 and interval +1 of YTDQ3</td>
<td>stayed in the same interval</td>
<td>interval +1 of YTDQ3</td>
<td>Table 5</td>
</tr>
<tr>
<td>3</td>
<td>(3.3)</td>
<td>H2a</td>
<td>CG2 and interval +1 of YTDQ3</td>
<td>moved down one interval</td>
<td>interval +1 of YTDQ3</td>
<td>Table 6</td>
</tr>
</tbody>
</table>

In each logistic regression, the coefficient \( \beta_1 \) on dummy variable DUM\(_k\) is of interest for testing hypotheses H1a and H2a. It represents the change in the log of odds for the interval shift described by the response variable \( Y_k \), if a firm belonged to the interval described by DUM\(_k\), instead of belonging to the control group CG2.

The logistic regression results are reported in Tables 4, 5 and 6, where Panel A (Panel B) in each table reports results for the period 1976-1994 (1995-2004). The psuedo-R\(^2\) statistic, which
is computed by SAS, is reported in each table. We do not report the coefficients on industry and year dummies for the sake of brevity.

Table 4 provides logistic regression estimates of equation (3.1) to test the first hypothesis of loss avoidance, H1a, by examining whether the odds of moving one interval up during the fourth quarter by firms in the smallest loss interval of YTDQ3 are significantly higher than odds of moving one interval up by control group firms. *The first hypothesis of loss avoidance predicts that in equation (3.1) coefficient $\beta_1 > 0$.* The coefficient $\beta_1$ on DUM1 is not significantly different from zero in both periods, indicating that odds of a firm from -1 interval of YTDQ3 shifting to +1 interval of NI are not different from the odds of control group firms moving up one interval during the fourth quarter. This evidence is inconsistent with the first hypothesis of loss avoidance, H1a. Of the remaining coefficients, the coefficient $\beta_2$ on size and $\beta_3$ on book-to-market are significantly different from 0, with $\beta_2$ being positive at the .01 level while $\beta_3$ is negative at least at the .05 level in both the BD and post-BD period. The psuedo-$R^2$ is close to 7% in the BD period and close to 10% in the post-BD period.

Table 5 provides logistic regression estimates of equation (3.2) to test whether odds of staying in the same interval during the fourth quarter by firms in the smallest profit interval of YTDQ3 are significantly higher than odds of staying in the same interval by control group firms. *The second loss avoidance hypothesis predicts that in equation 3.2, $\beta_1 > 0$.* The coefficient $\beta_1$ on DUM2 is 0.287 for BD period, 1976-1994, and is significant at 5% level or better. It implies that the smallest YTDQ3 profit interval firms have 33.24% higher odds of staying in the same interval than odds of control group firms staying in the same interval. For post-BD period, 1995-2005, the odds for the smallest YTDQ3 profit interval firms are 31.39% higher than the like odds for the control group firms. The difference in odds is significant at better than 5% level. In both
time periods, the coefficient $\beta_2$ on size is positive and significant at better than 0.1% level, while the coefficient $\beta_3$ on book-to-market is negative and also significant at better than 0.1% level. The psuedo-$R^2$s are greater than 11% in both periods.

Results of Table 5 indicate that firms in the smallest YTDQ3 profits interval reported the smallest annual profit, i.e., stayed in the same interval, at a significantly higher rate. As an additional test of the second loss avoidance hypothesis, we examine whether the smallest YTDQ3 profit firms avoid reporting smallest annual losses. Table 6 provides logistic regression estimates of equation (3.3) which examines whether odds of moving one interval down during the fourth quarter by firms in the smallest profit interval of YTDQ3 are significantly lower than odds of moving one interval down by control group firms. The second loss avoidance hypothesis predicts that in equation 3.3, $\beta_1 < 0$. The coefficient $\beta_1$ on $DUM_3$ is $-0.668$ for BD period, 1976-1994, and is significant at better than 0.1% level. It implies that the smallest YTDQ3 profit interval firms have 48.73% lower odds of moving to the smallest annual loss interval, than odds of control group firms moving one interval down. For post-BD period, 1995-2005, the odds for the smallest YTDQ3 profit interval firms are 31.75% lower than odds of one interval down shift by control group firms. The difference in odds is significant at better than 1% level. In both time periods, the coefficient $\beta_2$ on size is not significant, while the coefficient $\beta_3$ on book-to-market is negative and significant at better than 0.1% level. The psuedo-$R^2$ is 12.65% for the BD period and 8.71% for post-BD period.

Additional results, not reported for the sake of brevity, indicate that the shift by the smallest YTDQ3 profit interval firms to the next higher interval is not significantly different from a shift to the next higher interval by control group firms. Combined with evidence in Tables 5 and 6, these results provide further support to the second hypothesis of loss avoidance.
We also examine destinations of the smallest YTDQ3 loss firms (i.e., what were their interval locations in the distribution of annual earnings) and origins of the smallest annual profit firms (i.e., what were their interval locations in the distribution of YTDQ3). Un-tabulated results show that in both BD and post-BD period, more than 62% of the smallest YTDQ3 loss firms reported annual losses; and more than 65% of the smallest annual profit firms reported YTDQ3 profits.

3.6 Sensitivity analysis
In our logistic regressions in Tables 4-6, the control group CG2, consists of firms in the –2 or +2 cumulative third quarter earnings intervals. We tested the sensitivity of these results by using other control groups CG3, CG4, and CG5, described in Table 3. We also tested the robustness of our results by using a control group consisting of immediately surrounding intervals as the control group, similar to the implicit control group of BD, even though these include either +1 or –1. During the BD and post-BD period, our logistic regression results remain qualitatively the same for all but the control groups furthest away from the kink. This is consistent with the results of Table 3. As an additional test, we run weighted logistic regressions since control groups contain a higher proportion of profit firms than loss firms. We obtained qualitatively similar results.

\[\text{12 For example, BD use } -2 \text{ and } +1 \text{ as the 'control group' for } -1, \text{ while using } -1 \text{ and } +2 \text{ as the 'control group' for } +1.\]
\[\text{13 We weighted the observations in the control groups of Tables 4-6 so that the firms in the positive intervals have the same total weights as the firms in the negative intervals.}\]
4. Conclusion

We extend BD, Hayn and other research that examines the kink in annual earnings by using logistic regressions to model “normal” shifts in the earnings distribution during the fourth quarter. The main benefit of our methodology is that it can provide strong inferences about earnings management without having to estimate directly the pre-managed earnings distribution. Thus, our approach avoids the econometric problems that are inherent in the calculation of discretionary accruals. By modeling normal shifts, we identify the abnormal earnings paths by which firms avoided smallest losses, either by converting the smallest year-to-date third quarter losses into the smallest annual profits or by preventing the smallest year-to-date third quarter profits from turning into the smallest annual losses. Our assumption is that firms taking these abnormal paths into the smallest annual profit interval managed earnings up from the smallest pre-managed annual losses.

We focus on the fourth quarter because it provides an opportunity to observe the evolution of the kink given that managers have one last opportunity during the year to manage annual earnings. Thus, a comparison between year-to-date third quarter earnings and annual earnings yields potential insights into how managers use this opportunity.

Our results provide evidence that firms with the smallest YTDQ3 losses report the smallest annual profit at normal rates, and they report the smallest annual loss at an abnormally lower rate. Further, these firms end up reporting larger annual loss. Collectively these results provide a partial explanation for the low frequency of the smallest annual loss interval. Firms with the smallest YTDQ3 profit report the smallest annual profit at an abnormally higher rate, they report the smallest annual loss at an abnormally lower rate, and they report higher annual profit at
normal rates. Further, these firms had higher YTDQ3 profits. These results partially explain the high frequency of the smallest annual profit interval.

Our research has clear implications for the auditing practice as well. It appears that auditors may be preventing firms in the fourth quarter that have cumulative third quarter losses from managing earnings upward to achieve smallest profits. This is consistent with objectives of SEC’s Staff Accounting Bulletin No. 99. However, the primary abnormal migration pattern that we observe in the fourth quarter is the abnormal tendency by firms to stay in the smallest profit interval rather than shift into the smallest loss interval. This suggests that firms avoiding smallest losses most likely prevent year-to-date profits from turning into annual losses rather than convert year-to-date losses into annual profits. Auditors should also focus more on trying to prevent the earnings management tendencies of these firms.

References


### Table 1

Descriptive statistics by year for scaled values of earnings

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976</td>
<td>2,143</td>
<td>0.138</td>
<td>0.279</td>
<td>0.089</td>
<td>0.163</td>
<td>0.247</td>
</tr>
<tr>
<td>1977</td>
<td>2,091</td>
<td>0.127</td>
<td>0.207</td>
<td>0.085</td>
<td>0.141</td>
<td>0.206</td>
</tr>
<tr>
<td>1978</td>
<td>2,018</td>
<td>0.153</td>
<td>0.178</td>
<td>0.104</td>
<td>0.157</td>
<td>0.222</td>
</tr>
<tr>
<td>1979</td>
<td>2,018</td>
<td>0.154</td>
<td>0.197</td>
<td>0.103</td>
<td>0.162</td>
<td>0.231</td>
</tr>
<tr>
<td>1980</td>
<td>1,964</td>
<td>0.110</td>
<td>0.225</td>
<td>0.081</td>
<td>0.132</td>
<td>0.192</td>
</tr>
<tr>
<td>1981</td>
<td>2,861</td>
<td>0.081</td>
<td>0.198</td>
<td>0.030</td>
<td>0.097</td>
<td>0.166</td>
</tr>
<tr>
<td>1982</td>
<td>3,804</td>
<td>0.022</td>
<td>0.272</td>
<td>-0.026</td>
<td>0.068</td>
<td>0.133</td>
</tr>
<tr>
<td>1983</td>
<td>3,851</td>
<td>0.007</td>
<td>0.319</td>
<td>-0.030</td>
<td>0.071</td>
<td>0.133</td>
</tr>
<tr>
<td>1984</td>
<td>4,050</td>
<td>0.008</td>
<td>0.211</td>
<td>-0.030</td>
<td>0.056</td>
<td>0.103</td>
</tr>
<tr>
<td>1985</td>
<td>4,054</td>
<td>-0.044</td>
<td>0.310</td>
<td>-0.078</td>
<td>0.046</td>
<td>0.100</td>
</tr>
<tr>
<td>1986</td>
<td>4,076</td>
<td>-0.055</td>
<td>0.318</td>
<td>-0.082</td>
<td>0.036</td>
<td>0.085</td>
</tr>
<tr>
<td>1987</td>
<td>4,264</td>
<td>-0.027</td>
<td>0.257</td>
<td>-0.059</td>
<td>0.040</td>
<td>0.087</td>
</tr>
<tr>
<td>1988</td>
<td>4,336</td>
<td>-0.030</td>
<td>0.302</td>
<td>-0.074</td>
<td>0.049</td>
<td>0.103</td>
</tr>
<tr>
<td>1989</td>
<td>4,146</td>
<td>-0.050</td>
<td>0.314</td>
<td>-0.080</td>
<td>0.043</td>
<td>0.095</td>
</tr>
<tr>
<td>1990</td>
<td>4,080</td>
<td>-0.078</td>
<td>0.358</td>
<td>-0.097</td>
<td>0.032</td>
<td>0.082</td>
</tr>
<tr>
<td>1991</td>
<td>4,039</td>
<td>-0.142</td>
<td>0.590</td>
<td>-0.139</td>
<td>0.032</td>
<td>0.087</td>
</tr>
<tr>
<td>1992</td>
<td>4,160</td>
<td>-0.074</td>
<td>0.398</td>
<td>-0.084</td>
<td>0.030</td>
<td>0.077</td>
</tr>
<tr>
<td>1993</td>
<td>4,418</td>
<td>-0.037</td>
<td>0.283</td>
<td>-0.069</td>
<td>0.036</td>
<td>0.077</td>
</tr>
<tr>
<td>1994</td>
<td>4,678</td>
<td>-0.013</td>
<td>0.194</td>
<td>-0.041</td>
<td>0.044</td>
<td>0.076</td>
</tr>
<tr>
<td>Total</td>
<td>67,051</td>
<td>0.013</td>
<td>0.285</td>
<td>-0.021</td>
<td>0.076</td>
<td>0.132</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>4,901</td>
<td>-0.023</td>
<td>0.219</td>
<td>-0.060</td>
<td>0.043</td>
<td>0.085</td>
</tr>
<tr>
<td>1996</td>
<td>5,480</td>
<td>-0.025</td>
<td>0.256</td>
<td>-0.057</td>
<td>0.040</td>
<td>0.082</td>
</tr>
<tr>
<td>1997</td>
<td>5,908</td>
<td>-0.048</td>
<td>0.283</td>
<td>-0.082</td>
<td>0.031</td>
<td>0.075</td>
</tr>
<tr>
<td>1998</td>
<td>5,919</td>
<td>-0.069</td>
<td>0.297</td>
<td>-0.099</td>
<td>0.021</td>
<td>0.064</td>
</tr>
<tr>
<td>1999</td>
<td>5,743</td>
<td>-0.092</td>
<td>0.406</td>
<td>-0.128</td>
<td>0.027</td>
<td>0.077</td>
</tr>
<tr>
<td>2000</td>
<td>5,866</td>
<td>-0.096</td>
<td>0.406</td>
<td>-0.129</td>
<td>0.010</td>
<td>0.078</td>
</tr>
<tr>
<td>2001</td>
<td>5,775</td>
<td>-0.249</td>
<td>0.767</td>
<td>-0.232</td>
<td>-0.024</td>
<td>0.055</td>
</tr>
<tr>
<td>2002</td>
<td>5,527</td>
<td>-0.230</td>
<td>0.808</td>
<td>-0.213</td>
<td>-0.017</td>
<td>0.056</td>
</tr>
<tr>
<td>2003</td>
<td>5,153</td>
<td>-0.212</td>
<td>0.838</td>
<td>-0.209</td>
<td>0.020</td>
<td>0.075</td>
</tr>
<tr>
<td>2004</td>
<td>4,544</td>
<td>-0.067</td>
<td>0.385</td>
<td>-0.086</td>
<td>0.030</td>
<td>0.069</td>
</tr>
<tr>
<td>Total</td>
<td>54,816</td>
<td>-0.111</td>
<td>0.466</td>
<td>-0.130</td>
<td>0.018</td>
<td>0.072</td>
</tr>
</tbody>
</table>

**Panel B: the period 1995-2004, years subsequent to Burgstahler and Dichev (1997)**

Notes:

(a) Annual earnings are annual net income (Compustat item #172) scaled by beginning of the year market value of equity (Compustat items # 25 x # 199).

(b) Annual earnings equal to zero are not included.

(c) 25%, 50% and 75% columns represent the 1st Quartile, the Median and the third Quartile values, respectively.

(d) For each panel, rows labeled 'Total' show the total observation for column 'N', and year-wise average values for the remaining columns.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency Third Quarter (YTDQ3)</th>
<th>Frequency Annual Earnings (NI)</th>
<th>Frequency change during the fourth quarter % change</th>
<th>Z-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Years 1976-1994</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>742</td>
<td>304</td>
<td>-59.03%</td>
<td>-5.36(^b)</td>
</tr>
<tr>
<td>1</td>
<td>1,065</td>
<td>913</td>
<td>-14.27%</td>
<td>4.95(^b)</td>
</tr>
<tr>
<td>Average % change in intervals -5 to +5</td>
<td></td>
<td></td>
<td>-35.75%</td>
<td></td>
</tr>
<tr>
<td>Standard deviation of % changes in intervals -5 to +5</td>
<td></td>
<td></td>
<td>13.02%</td>
<td></td>
</tr>
<tr>
<td>Panel B: Years 1995-2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>874</td>
<td>495</td>
<td>-43.36%</td>
<td>-5.16(^b)</td>
</tr>
<tr>
<td>1</td>
<td>1,069</td>
<td>844</td>
<td>-21.05%</td>
<td>5.20(^b)</td>
</tr>
<tr>
<td>Average % change in intervals -5 to +5</td>
<td></td>
<td></td>
<td>-32.25%</td>
<td></td>
</tr>
<tr>
<td>Standard deviation of % changes in intervals -5 to +5</td>
<td></td>
<td></td>
<td>6.46%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 notes:
Intervals refer to those of earnings metrics YTDQ3, and NI, defined below. Intervals are centered around the zero profit line. Each interval width is 0.005 and is same for all earnings metrics. Interval +1 (-1) is the smallest profit (loss) interval of its respective earnings metrics.

- **MV** = market value at the beginning of the year = Annual Compustat item # 25 X item # 199 in millions of dollars.
- **YTDQ3** = Year-to-date earnings at the end of the third fiscal quarter / MV = Compustat (Quarterly item #69:(Q1+Q2+Q3))/MV
- **NI** = Annual earnings = Compustat annual item #172 / MV
- **% change** = (Frequency in the interval of NI - Frequency in the interval of YTDQ3)/(Frequency in the interval of YTDQ3)
- **Z-Value** = change/(std. deviation/√n) where n = degrees of freedom. k = -1 or +1. Average change (std. deviation) is the average (standard deviation) of percent changes in intervals -5 to +5.

\(^a\) Significant at 0.1% or higher level for the hypothesis that the standardized change in the smallest loss interval < 0 or the standardized change in the smallest profit interval > 0
### Table 3

Earnings interval shifts by firms with smallest losses or smallest profits during the fourth quarter: Comparison with control groups

<table>
<thead>
<tr>
<th>Interval shift</th>
<th>% Shift (X)</th>
<th>Relative shift (Y)</th>
<th>CG2</th>
<th>CG3</th>
<th>CG4</th>
<th>CG5</th>
</tr>
</thead>
<tbody>
<tr>
<td>From interval of</td>
<td>To interval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YTDQ3</td>
<td>of NI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>+1</td>
<td>10.11%</td>
<td>0.42%</td>
<td>-0.93%</td>
<td>-1.31%</td>
<td>-1.34%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.33)</td>
<td>(-0.75)</td>
<td>(-1.07)</td>
<td>(-1.16)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.18%</td>
<td>4.21%</td>
<td>4.98%</td>
<td>5.91%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.45)</td>
<td>(3.54)</td>
<td>(4.34)</td>
<td>(5.24)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-3.78%</td>
<td>-3.57%</td>
<td>-2.67%</td>
<td>-2.07%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-4.16)</td>
<td>(-4.54)</td>
<td>(-3.63)</td>
<td>(-2.92)</td>
<td></td>
</tr>
<tr>
<td>+1</td>
<td>-1</td>
<td>4.79%</td>
<td>-1.73%</td>
<td>-2.32%</td>
<td>-1.99%</td>
<td>-1.31%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-1.23)</td>
<td>(-1.82)</td>
<td>(-1.62)</td>
<td>(-1.06)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.34%</td>
<td>4.55%</td>
<td>5.84%</td>
<td>6.72%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.45)</td>
<td>(3.65)</td>
<td>(4.85)</td>
<td>(5.67)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-2.48%</td>
<td>-1.86%</td>
<td>-1.17%</td>
<td>-0.33%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-2.37)</td>
<td>(-1.99)</td>
<td>(-1.32)</td>
<td>(0.37)</td>
<td></td>
</tr>
</tbody>
</table>

**Panel A: Years 1976-1994**

**Panel B: Years 1995-2004**

### Table 3 Notes:

Intervals refer to those of earnings metrics YTDQ3, and NI, defined below. Intervals are centered around the zero profit line. Each interval width is 0.005 and is same for all earnings metrics. Interval +1 (-1) is the smallest profit (loss) interval of its respective earnings metrics.

- **MV** = market value at the beginning of the year = Annual Compustat item # 25 X item # 199 in millions of dollars.
- **YTDQ3** = Year-to-date earnings at the end of the third fiscal quarter / MV = Compustat (Quarterly item #69:(Q1+Q2+Q3))/MV
- **NI** = Annual earnings = Compustat annual item #172 / MV
- **X** = percentage of firms in the smallest loss or the smallest profit interval of YTDQ3 that shifted to the given interval of NI
- **CGn** = control group consisting of firms in YTDQ3 intervals -n to -2 and +2 to +n. For example, CG4 consists of firms in YTDQ3 intervals -2 to -4 and +2 to +4.
- **Y** = Relative shift = X - an equivalent shift by a control group

For measuring Y, an equivalent shift by a control group is defined as the shift of an equal length and direction as the treatment group. For example, to measure Y for shift by firms from -1 interval of YTDQ3 to +1 interval of NI, i.e., a shift of one-interval-to-the-right in the distribution, we measure one-interval-to-the-right shifts by firms in the control group, and subtract it from X.

Numbers in parentheses are t-statistics for tests of the following hypotheses:

1. For the shift from interval -1 of YTDQ3 to +1 of NI, the one tailed test that Y > 0
2. For the shift from interval +1 of YTDQ3 to +1 of NI, the one tailed test that Y > 0
3. For the shift from interval +1 of YTDQ3 to -1 of NI, the one tailed test that Y < 0

*a* significant at 0.1%; *b* significant at 1%; *c* significant at 5%; *d* significant at 10%.
Table 4

Logistic regression to test loss avoidance hypotheses: Examination of abnormal shifts from the smallest three-quarter loss interval to the smallest annual profit interval

\[ \log \text{it}(p_1) = \alpha + \beta_1 \text{DUM}_1 + \beta_2 \text{SIZE} + \beta_3 \text{BM} + \sum_{i} \gamma_i \text{IND}_i + \sum_{j} \eta_j \text{YR}_j + \epsilon \]  
(3.1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Mean Estimate</th>
<th>( \Delta ) Odds (%)</th>
<th>Wald Chi-Sq</th>
<th>Pr &gt; Chi-Sq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>( \alpha )</td>
<td>-14.576</td>
<td>0.00</td>
<td>0.968</td>
<td></td>
</tr>
<tr>
<td>\text{DUM}_1</td>
<td>( \beta_1 )</td>
<td>0.041</td>
<td>4.19%</td>
<td>0.07</td>
<td>0.786</td>
</tr>
<tr>
<td>\text{SIZE}</td>
<td>( \beta_2 )</td>
<td>0.181</td>
<td>18.21%</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>\text{BM}</td>
<td>( \beta_3 )</td>
<td>-0.247</td>
<td>3.89%</td>
<td>0.049</td>
<td></td>
</tr>
</tbody>
</table>

Panel A: Years 1976-1994

Model Statistics: Number of observations = 2,713; \( R^2 = 10.31 \); Likelihood ratio test for \( \beta = 0 \): Chi-square = 135.79 \( p < 0.0001 \).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Mean Estimate</th>
<th>( \Delta ) Odds (%)</th>
<th>Wald Chi-Sq</th>
<th>Pr &gt; Chi-Sq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>( \alpha )</td>
<td>-2.454</td>
<td>5.09</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>\text{DUM}_1</td>
<td>( \beta_1 )</td>
<td>-0.110</td>
<td>-10.42%</td>
<td>0.81</td>
<td>0.369</td>
</tr>
<tr>
<td>\text{SIZE}</td>
<td>( \beta_2 )</td>
<td>0.184</td>
<td>40.88%</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>\text{BM}</td>
<td>( \beta_3 )</td>
<td>-0.474</td>
<td>9.51%</td>
<td>0.002</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Years 1995-2004

Model Statistics: Number of observations = 2,962; \( R^2 = 11.43 \); Likelihood ratio test for \( \beta = 0 \): Chi-square = 196.33 \( p < 0.0001 \).

Table 4 notes:

The table provides estimates of equation (3.1) using logistic regression. The dependent variable is the logistic of the probability \( p_1 \) of shifting from a year-to-date earnings interval after three quarters (YTDQ3, defined below) to the next higher interval of annual earnings (NI, defined below).

The sample consists of firms in the smallest loss interval of YTDQ3 and a control group consisting of firms in the surrounding intervals -2 and +2. The control group is set up as the base case. The probability of migration, if a firm belongs to the control group is:

\[ p = 1 / [1 + \exp \left( - (\alpha + \beta_2 \text{SIZE} + \beta_3 \text{BM} + \sum_k \gamma_k \text{IND}_k + \sum_j \eta_j \text{YR}_j) \right) ] \]

\( \Delta \) Odds (%) column shows the percentage change in odds of migrating from an earnings interval of YTDQ3 to the next higher interval of NI if a firm belongs to the smallest loss interval of YTDQ3 instead of to the control group.

Variable definitions:
(a) YTDQ3 = year-to-date earnings after three quarters/MV
   = Compustat (Quarterly item #69:(Q1+Q2+Q3))/MV
   where: MV = Beginning period market value = (Annual Compustat item #25 x item #199) in millions of dollars
(b) NI = Annual earnings = Compustat annual item #172/MV
(c) \( Y_1 \) (response variable) = 1 if a firm migrated from an earnings interval of YTDQ3 to the next higher interval of NI; = 0 otherwise.
(d) \( p_1 \) = probability that \( Y_1 = 1 \)
(e) \text{DUM}_1 = 1 if a firm is in the smallest loss interval of YTDQ3; = 0 otherwise.
(f) \text{SIZE} = Log (MV)
(g) \text{BM} = Book-to-market value at the beginning of the year
   = Compustat annual (item#216)/MV
(h) \text{IND}_i = Industry dummy = 1 if 2-digit SIC code of a firm's industry = i; = 0 otherwise.
(i) \text{YR}_j = Year Dummy = 1 if fiscal year = j; = 0 otherwise. j = 1977 to 1994 in Panel A; and j = 1996 to 2004 in Panel B. Year 1976 (1995) is omitted as a base case in Panel A (panel B).
Table 5
Logistic regression to test loss avoidance hypothesis: Examination of abnormal shift from the smallest three-quarter profit interval to the smallest annual profit interval

\[
\log \it(p_2) = \alpha + \beta_1 \text{DUM}_2 + \beta_2 \text{SIZE} + \beta_3 \text{BM} + \sum_{i} \gamma_i \text{IND}_i + \sum_{j} \eta_j \text{YR}_j + \epsilon
\]

(3.2)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Mean Estimate</th>
<th>(\Delta) Odds (%)</th>
<th>Wald Chi-Sq</th>
<th>Pr &gt; Chi-Sq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>(\alpha)</td>
<td>-2.081</td>
<td>8.60</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>DUM2</td>
<td>(\beta_1)</td>
<td>0.287</td>
<td>33.24%</td>
<td>6.04</td>
<td>0.014</td>
</tr>
<tr>
<td>SIZE</td>
<td>(\beta_2)</td>
<td>0.162</td>
<td>20.07</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>(\beta_3)</td>
<td>-0.599</td>
<td>28.13</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
</tbody>
</table>

Panel A: Years 1976-1994

- Model Statistics: Number of observations = 3,036; \(R^2 = 11.14\); Likelihood ratio test for \(\beta = 0\): Chi-square = 185.13 (\(p < 0.0001\)).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Mean Estimate</th>
<th>(\Delta) Odds (%)</th>
<th>Wald Chi-Sq</th>
<th>Pr &gt; Chi-Sq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>(\alpha)</td>
<td>-1.286</td>
<td>2.99</td>
<td>0.084</td>
<td></td>
</tr>
<tr>
<td>DUM2</td>
<td>(\beta_1)</td>
<td>0.273</td>
<td>31.39%</td>
<td>6.23</td>
<td>0.013</td>
</tr>
<tr>
<td>SIZE</td>
<td>(\beta_2)</td>
<td>0.175</td>
<td>41.90</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>(\beta_3)</td>
<td>-0.716</td>
<td>25.57</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Years 1995-2004

- Model Statistics: Number of observations = 3,157; \(R^2 = 11.98\); Likelihood ratio test for \(\beta = 0\): Chi-square = 220.03 (\(p < 0.0001\)).

Table 5 notes:

The table provides estimates of equation (3.2) using logistic regression. The dependent variable is the logistic of the probability \(p_2\) of shifting from a year-to-date earnings interval after three quarters (YTDQ3, defined below) to the same interval of annual earnings (NI, defined below). The sample consists of firms in the smallest profit interval of YTDQ3 and a control group consisting of firms in the surrounding intervals -2 and +2. The control group is set up as the base case. The probability of migration, if a firm belongs to the control group is:

\[
p = \frac{1}{1 + \exp(-\alpha - \beta_2 \text{SIZE} + \beta_3 \text{BM} + \sum_k \gamma_k \text{IND}_k + \sum_j \eta_j \text{YR}_j)}
\]

\(\Delta\) Odds (%) column shows the percentage change in odds of migrating from an earnings interval of YTDQ3 to the same interval of NI if a firm belongs to the smallest loss interval of YTDQ3 instead of to the control group. Variable definitions:

(a) YTDQ3 = year-to-date earnings after three quarters \(\div\) MV

(b) NI = Annual earnings = Compustat annual item #172 \(\div\) MV

(c) \(Y_2\) (response variable) = 1 if a firm migrated from an earnings interval of YTDQ3 to the same interval of NI; = 0 otherwise.

(d) \(p_2\) = probability that \(Y_2 = 1\)

(e) DUM2 = 1 if a firm is in the smallest profit interval of YTDQ3; = 0 otherwise.

(f) SIZE = Log (MV)

(g) BM = Book-to-market value at the beginning of the year = Compustat annual (item#216) \(\div\) MV

(h) INDi = Industry dummy = 1 if 2-digit SIC code of a firm's industry = i; = 0 otherwise.

(i) YRj = Year Dummy = 1 if fiscal year = j; = 0 otherwise. j = 1977 to 1994 in Panel A; and j = 1996 to 2004 in Panel B. Year 1976 (1995) is omitted as a base case in Panel A (panel B).
Table 6
Logistic regression to test loss avoidance hypotheses: Examination of abnormal shifts from the smallest three-quarter profit interval to the smallest annual loss interval

\[
\log \text{it}(p_{3}) = \alpha + \beta_1 DUM_3 + \beta_2 SIZE + \beta_3 BM + \sum_{i} \gamma_i IND_i + \sum_{j} \eta_j YR_j + \varepsilon \tag{3.3}
\]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Mean Estimate</th>
<th>(\Delta) Odds (%)</th>
<th>Wald Chi-Sq</th>
<th>Pr &gt; Chi-Sq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>(\alpha)</td>
<td>-2.382</td>
<td>4.73</td>
<td>0.0297</td>
<td></td>
</tr>
<tr>
<td>DUM3</td>
<td>(\beta_1)</td>
<td>-0.668</td>
<td>-48.73%</td>
<td>15.50</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>SIZE</td>
<td>(\beta_2)</td>
<td>0.048</td>
<td>1.00</td>
<td>0.317</td>
<td></td>
</tr>
<tr>
<td>BM</td>
<td>(\beta_3)</td>
<td>-0.575</td>
<td>31.18</td>
<td>&lt; 0.001</td>
<td></td>
</tr>
</tbody>
</table>

Panel A: Years 1976-1994

Model Statistics: Number of observations = 3,036; \(R^2 = 12.65\); Likelihood ratio test for \(\beta = 0\): Chi-square =159.81 (\(p < 0.0001\)).

| Constant   | \(\alpha\)  | -1.800        | 2.69                 | 0.101       |             |
| DUM3       | \(\beta_1\) | -0.382        | -31.75%              | 7.44        | 0.006       |
| SIZE       | \(\beta_2\) | 0.036         | 1.36                 | 0.244       |             |
| BM         | \(\beta_3\) | -0.839        | 29.38                | < 0.001     |             |

Panel B: Years 1995-2004

Model Statistics: Number of observations = 3,157; \(R^2 = 8.71\); Likelihood ratio test for \(\beta = 0\): Chi-square =129.65 (\(p < 0.0001\)).

Table 6 notes:

The table provides estimates of equation (3.3) using logistic regression. The dependent variable is the logistic of the probability \(p_{3}\) of shifting from a year-to-date earnings interval after three quarters (YTDQ3, defined below) to the next lower interval of annual earnings (NI, defined below).

The sample consists of firms in the smallest profit interval of YTDQ3 and a control group consisting of firms in the surrounding intervals -2 and +2. The control group is set up as the base case. The probability of migration, if a firm belongs to the control group is:

\[
p = \frac{1}{1 + \exp(-\alpha + \beta_2 \cdot SIZE + \beta_3 \cdot BM + \sum_k \gamma_k \cdot IND_k + \sum_j \eta_j \cdot YR_j)}
\]

\(\Delta\) Odds (%) column shows the percentage change in odds of migrating from an earnings interval of YTDQ3 to the next lower interval of NI if a firm belongs to the smallest loss interval of YTDQ3 instead of to the control group.

Variable definitions:
(a) YTDQ3 = year-to-date earnings after three quarters/\(\text{MV}\)
   = Compustat (Quarterly item #69:(Q1+Q2+Q3))/\(\text{MV}\)
where: \(\text{MV}\) = Beginning period market value = (Annual Compustat item #25 x item #199) in millions of dollars
(b) NI = Annual earnings = Compustat annual item #172/\(\text{MV}\)
(c) \(Y_3\) (response variable) = 1 if a firm migrated from an earnings interval of YTDQ3 to the next lower interval of NI; = 0 otherwise.
(d) \(p_{3}\) = probability that \(Y_3 = 1\)
(e) DUM3 = 1 if a firm is in the smallest profit interval of YTDQ3; = 0 otherwise.
(f) SIZE = Log (\(\text{MV}\))
(g) BM = Book-to-market value at the beginning of the year
   = Compustat annual (item#216)/\(\text{MV}\)
(h) INDi = Industry dummy = 1 if 2-digit SIC code of a firm’s industry = \(i\); = 0 otherwise.
(i) YRj = Year Dummy = 1 if fiscal year = \(j\); = 0 otherwise. \(j = 1977\) to 1994 in Panel A; and \(j = 1996\) to 2004 in Panel B.
Year 1976 (1995) is omitted as a base case in Panel A (panel B).
Figure 1(a) Frequency distribution of scaled annual earnings: 1976-1994
Figure 1(b) Frequency distribution of year-to-date earnings after three quarters: 1976-1994
Figure 2(a) Frequency distribution of scaled annual earnings: 1995-2004
Figure 2(b) Frequency distribution of scaled year-to-date earnings after three quarters
1995-2004

Earnings interval

Frequency