Earnings Management and Accounting Income Aggregation*

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Abstract

Quarterly earnings allow aggregation into annual earnings in four different ways. Fiscal year reported earnings is one of these four possible measures of annual earnings, the others being earnings for annual periods ending at the first, second, and third fiscal quarters. We provide evidence on earnings management in fiscal year earnings relative to these three alternative measures of firms' annual earnings. We confirm prior findings in Burgstahler and Dichev (1997) of discontinuities around zero and around prior year earnings in histograms of fiscal year earnings. Subsequent research questions whether these discontinuities are evidence of earnings management or whether they are attributable to biases induced by scaling, sample selection and taxes. Using the histograms of our alternative annual earnings measures, we offer evidence that these biases are not responsible for the basic Burgstahler and Dichev (1997) findings. We also find evidence of earnings management in wider intervals around thresholds. We believe that our methodology has broad applicability both in testing for earnings management and in other contexts.

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Earnings Management and Accounting Income Aggregation

I. **Introduction**

Perhaps the greatest challenge facing researchers investigating earnings management is correctly specifying what earnings would be in the absence of manipulation, i.e., under the null hypothesis. For example, many papers test for accrual management using variations of the Jones (1991) model to estimate normal accruals under the null hypothesis. However, Dechow, Sloan and Sweeney (1995) find that these models are mis-specified for firms exhibiting extreme performance and also lack power. Using market based tests, Guay, Kothari and Watts (1996) find that the Jones model estimates discretionary accruals, and therefore non-discretionary accruals, with considerable imprecision. Similar concerns also apply to the recent cross-sectional studies based on histograms of earnings that compare neighboring partitions and document a discontinuity. In this paper we present an intuitive approach to specifying the null hypothesis for studies that examine the distribution of earnings and related variables. Using this approach, we present evidence that informs to the debate about the nature of discontinuities in the earnings distribution. We believe that this approach has wider applicability and can be used to test for manipulation of accounting numbers in other contexts.

In seminal papers, Hayn (1995) and Burgstahler and Dichev (1997, henceforth BD) document the existence and prevalence of a discontinuity around zero earnings and zero earnings changes. BD documents that the histograms of scaled net income and changes in net income have discontinuities around zero with a disproportionately low frequency in the partition immediately to the left of zero and a disproportionately high frequency in the partition which includes zero. They attribute these findings to earnings management by firms to meet earnings thresholds of zero earnings and the previous period's earnings. The BD paper has had a major impact on accounting research and their methodology is used in many subsequent papers investigating earnings management (including Beatty, Ke and Petroni, 2002, Dichev and

Skinner, 2002, Leuz, Nanda and Wysocki, 2003, Leone and Van Horn, 2003, Phillips, Pincus, Rego and Wan, 2003, Frank and Rego, 2004 and Roychowdhury, 2006).

Some subsequent studies, however, question the validity of the BD methodology, suggesting that the results may be induced by the scaling mechanism used. Degeorge, Patel and Zeckhauser (1999, henceforth DPZ), assert that these results might be affected by a problem similar to the "aliasing problem" in the literature on the spectral analysis of time-series data.[1] DPZ suggest that scaling disperses non-zero observations in the distribution while not dispersing observations that are exactly zero. They claim that this contributes to the discontinuity at zero in the distribution of earnings and earnings changes.

Durtschi and Easton (2005, henceforth DE) also assert that scaling could be responsible for the finding of discontinuities at zero in BD, both directly and indirectly through an induced sample selection bias. They find that firms reporting small losses are priced differently from firms that report small profits. A consequence of this phenomenon 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 histogram of deflated net income at zero. Therefore, even if the histogram of earnings did not have a discontinuity at zero, the histogram of scaled earnings would exhibit this discontinuity.

In this paper, we investigate issues related to the BD methodology to test for earnings management using earnings measured over alternative annual periods. These alternative annual periods end at the close of the first three quarters of the fiscal year. The intuition underlying the use of these alternative annual periods is that earnings measured over these periods are less likely to suffer from the effects of managerial income manipulation – through accrual or operating decisions – than earnings measured over the fiscal year. Since managers are unlikely

[1] To quote DPZ (footnote 25, page 19):
"A qualitatively similar pattern is reported in Burgstahler and Dichev (1997, fig. 1), although, since they deflate earnings, the extreme dip in density just below zero in their distribution of scaled earnings is most likely spurious."

to be evaluated based on earnings for annual periods other than the fiscal year, they have less incentive to manage these earnings. In addition, if fiscal year earnings are managed through the use of accounting accruals in the fourth quarter and if some of these accruals reverse over subsequent quarters, these alternative annual earnings might better represent the economic earnings for a year than the fiscal year earnings reported in annual financial statements.[2]

Using the histograms of our alternative estimates of annual earnings we examine whether the BD results are indeed a consequence of the scaling procedures they use. We construct a benchmark from the distribution of our alternative estimates of annual earnings and use this benchmark to investigate for discontinuities in the distribution of fiscal year earnings. A helpful feature of this benchmark is that we can discern earnings management over wider intervals of the distribution than was possible in prior research. Prior research concentrated on examining earnings management in the immediate neighborhood of specific thresholds. Unlike methods used in some prior papers, our benchmark is also valid for tests of discontinuities at the peak of the distribution.

We contribute to the current debate on whether the BD results are evidence of earnings management or whether, as asserted by DPZ, DE and Beaver, McNichols and Nelson (2003), they can be attributed to the effects of scaling, selection biases or the asymmetric effects of taxes on profit and loss firms. Our results, in general, validate the BD methodology as a test of earnings management.

In this paper, we assume that managers are particularly concerned about *fiscal year* earnings reported in companies' annual reports because many bonus and compensation schemes are based on earnings measured over this time period. These pay schemes provide incentives for managers to manipulate fiscal year income to maximize their compensation. Incentives to manage income are probably strongest in the fourth quarter of the fiscal year. At this time

[2] Results in Sloan (1996) and other papers suggest that accruals made in a period reverse over subsequent periods.

managers are likely to have a good sense of where they stand vis-à-vis annual targets. Consistent with this, prior research provides evidence that the characteristics of fourth quarter earnings differ from earnings for the other three quarters.[3] For example, fourth quarter earnings exhibit higher volatility. Capital markets seem to recognize this – the preponderance of research has found lower earnings response coefficients for fourth quarter earnings relative to other quarters (Salamon and Stober, 1994). We treat the firm's choice of fiscal year as exogenous to our investigation and do not view managers' choice of the fiscal year end as a strategic variable in the short-term.[4]

The rest of this paper is organized as follows. Section II surveys prior research in the area. Section III describes our research design and results. Section IV presents our conclusions.

II. Prior research

Studies on earnings management, including Hayn (1995), BD and DPZ, find a discontinuity around zero for levels and changes in earnings. This is suggestive of earnings management to avoid reporting losses and earnings decreases. DPZ and Burgstahler and Eames (2003) also report similar discontinuities around analysts' forecasts of earnings.[5]

Some recent studies question whether earnings management is responsible for the discontinuity around zero in the distribution of earnings, earnings changes and earnings surprises. DE suggest that the discontinuity at zero in net income scaled by the market value of equity is a consequence of the scaling mechanism used and of selection biases. They point out that, unlike the distribution of market value deflated net income, the distribution of earnings per share (EPS), which is a variable that investors and analysts focus on, shows no evidence of a

[3] See, among others, Collins, Hopwood and McKeown (1984), Das and Shroff (2002), Gu and Lee (2002), and Hayn, Narayanamoorthy, and Watts (2001).
[4] See Smith and Pourciau (1988) for evidence on differences in firm characteristics among December year end and other firms.
[5] We do not analyze earnings management to meet analysts' forecasts because our methodology does not lend itself to an examination of this question.

discontinuity at zero. They note that, in the histogram of EPS, there are significantly more observations with a small loss than a small profit. This would appear to be inconsistent with widespread earnings management to achieve a positive EPS benchmark. They also do not find evidence of a discontinuity at zero in the distribution of un-deflated net income. They assert that two factors could contribute to the observed discontinuity in market value deflated net income. First, a larger proportion of loss firms do not have a beginning of year price, which is used to construct the deflator, available on the Compustat annual files. This could result in a selection bias. Second, they find that the beginning of year prices for small loss firms are systematically lower than the corresponding figures for small profit firms. This could induce the observed discontinuities in scaled earnings because the deflator for firms that report a small loss is generally lower than the deflator for firms that report a small gain. Scaling, therefore, moves small loss firms less towards zero than small profit firms inducing the appearance of a discontinuity at zero. DE also find that scaling by total assets or revenues induces similar biases as scaling by market value of equity.

Beaver, McNichols, and Nelson (2003) investigate whether the asymmetric tax treatment of positive and negative earnings and special items could be responsible for the observed discontinuity at zero in the distribution of earnings and earnings changes. They do not rule out earnings management as contributing to the discontinuity. However, based on their investigations, they conclude that two thirds of the discontinuity could be attributed to these two factors.

Dechow, Richardson and Tuna (2003) investigate whether firms that just met thresholds of zero earnings and zero changes in earnings achieved these thresholds through accrual management. Using a battery of commonly used tests for accrual management, they fail to find evidence of such management in this sample of firms. They suggest that managers taking real

actions such as expending additional effort (as opposed to using accounting accruals) to meet earnings targets is more likely to be the reason for the observed discontinuities.[6]

Using the distributions of our alternate measures of annual earnings, we are able to shed some light on the debate over whether the observed discontinuities in the distribution of fiscal year earnings are attributable to earnings management or whether they are artifacts of the testing procedures used.

III. Research Design and Test Results

Incentives arising from compensation and other contracts could cause earnings management to be more pervasive at fiscal year end than at interim quarter ends. We attempt to discern patterns arising from this using a research design which allows each firm to serve as its own control. We measure annual earnings for time periods different from the fiscal year, specifically for annual periods terminating at the end of the first, second, and third quarters of the fiscal year. As argued earlier, the intuition underlying the use of these alternative measures is that the earnings management incentives present at fiscal year end are likely not as powerful at the end of interim quarters. If earnings management at fiscal year end is achieved through accrual manipulation and these accrual manipulations reverse in the following quarters, annual earnings measured over alternative annual periods may be less affected by the earnings management.

Our research design, however, has some limitations. There is evidence that firms also manage quarterly earnings to achieve thresholds. This phenomenon would render the patterns induced by earnings management to meet fiscal-year targets less distinct. Also some contracts, principally debt contracts, are based on earnings for rolling annual periods, i.e., the sum of earnings for the past four quarters.[7] This would provide incentives for firms to also manage

[6] In this paper, we do not discriminate between earnings management through accounting manipulation or through real actions.

[7] We thank the referee for pointing this out.

earnings for the non-fiscal year annual periods to comply with these contracts. Either of these types of earnings management would likely induce a bias against finding evidence of earnings management at fiscal year-end, i.e., it would bias our tests towards the null.

We present an example of how we compute earnings for our alternative annual periods in Table 1. The third column of the table has IBM's quarterly net income for the years 1999 to 2001. The last column presents the earnings aggregated over the four quarters ending at that quarter. These include both the fiscal year earnings and earnings in annual periods ending in the first, second, and third quarters.

Our initial sample consists of all firms on the quarterly Compustat database between 1981 and 2001. The sample contains 920,926 quarterly observations for 22,015 distinct firms from 1981 to 2001. Firm coverage varies from 6,482 firms in 1981 to 12,134 in 2001.

III.1 Tests of Earnings Management to Meet Thresholds using the BD Methodology

DPZ and DE suggest that the BD results could be spurious – induced by scaling and selection biases in the scaling variable. BD deflate earnings and earnings changes by market value of equity "because firms are drawn from a broad range of firm sizes." In addition, scaling modifies the histogram of earnings and earnings changes so that the peak of the distribution is not at zero. Most existing tests for discontinuities in histograms are difficult to apply at the peak of the distribution.

We examine the histograms of scaled annual net income computed over alternate annual periods as a preliminary investigation of whether scaling is responsible for the BD results. We first replicate the BD histograms for fiscal year earnings. We then construct these histograms for annual earnings measured over alternate periods, periods ending at the first, second, and third quarters of the fiscal year. If the patterns observed by BD arise because of some mechanical effect, such as the one induced by scaling, we are likely to observe similar patterns in the histograms of earnings for these other annual periods. If, on the other hand, the patterns they

find are attributable to earnings management at fiscal year end, we should find the pattern for fiscal year earnings but not for the other three annual periods.

We generate the histograms for net income scaled by market value of equity at the beginning of the year and for changes in net income scaled by market value of equity at the beginning of the prior year.[8] We compute the frequency of observations in each partition of the histogram where each partition has a width of 0.5 percent of market value of equity for the histogram of earnings levels and 0.25 percent of market value of equity for the histogram of earnings changes.[9] In our first tests, similar to BD, we compare the actual frequency with an expected frequency where the expected frequency is the mean of the actual frequency in the two adjacent partitions.[10] Also following BD, we compute a test (Z) statistic to evaluate the statistical significance of deviations from the expected frequency. This statistic, described in footnote 6 of BD, is the deviation from expected frequency in the partition deflated by the estimated standard deviation of the deviations from expected frequency.

Figures 1A through 1D depict the histograms of annual earnings deflated by beginning market value of equity. The discontinuity around zero is visually apparent for fiscal year earnings but not for annual earnings computed for the alternate periods. Table 2 presents frequencies for the forty partitions around zero. We present results for the four annual periods, i.e., for the fiscal year and for annual periods ending at the first, second, and third quarters. For each annual period, the table shows the actual frequency (expressed as a percentage of the total sample), the deviation from the expected frequency and the Z-statistic for the statistical significance of the deviation.

The results confirm the prior findings in BD for fiscal year annual earnings around zero (the first set of columns in the panel). The frequency in the partition immediately below zero,

[8] In sensitivity tests (unreported) we also deflate by total assets instead of market value of equity.
[9] BD use these same widths for their partitions.
[10] Also similar to BD, we test the sensitivity of our results to using alternative definitions of expected frequency. We use the mean of the two partitions, one partition away from the partition under consideration in one test and the mean of the four adjacent partitions, two on either side in another.

the -1 partition, is significantly lower than expected and the frequency in the partition including and immediately above zero, the 0 partition, is significantly higher than expected. The Z-statistics corresponding to these partitions are strongly significant, statistically. As BD suggest, this is consistent with management of annual earnings to avoid reporting losses. Further validating their analyses, we find that annual earnings computed using the alternate aggregation periods do not share these characteristics (except, to some extent, for the annual period ending in quarter one).[11] Also, the magnitude of the discontinuity around zero is considerably higher for fiscal year earnings than for any of the other three annual periods. As we move the reporting period away from the fiscal year, we may mix accruals in quarter four of the fiscal year with their partial reversal in the first quarters of the subsequent fiscal year. This reversal of discretionary short-lived accruals would render these patterns in earnings computed over the alternative periods less distinct. Alternatively, the discontinuity around zero in fiscal year earnings may become less distinct in other annual periods because the income effects of operating decisions, such as channel stuffing, also reverse in later quarters. *Prima facie*, these results do not support DPZ and DE's contention that scaling induces the results that BD report in the neighborhood of zero in the histogram of scaled earnings.

If earnings management is more prevalent at fiscal year-end than at the end of other quarters, the histogram of fiscal year earnings might be less smooth, i.e., have more discontinuities than the histogram of earnings for the other annual periods. We investigate this conjecture by computing the average of the absolute values of the Z-statistics for 400 partitions of the histograms of scaled earnings separately for each annual period. Consistent with this conjecture, we find that the average of the absolute value of the Z-statistic is considerably higher for the histogram of fiscal year earnings than for any of the other annual periods. The average Z-

[11] We conjecture that the reason we observe results for the annual period ending in quarter 1 similar but weaker than those for fiscal year earnings is that some of the accruals management at fiscal year end may not have completely reversed by the end of the first quarter.

statistic was 0.95 for the fiscal year earnings, 0.84 for annual periods ending in quarter 1, 0.79 for annual periods ending in quarter 2, and 0.81 for annual periods ending in quarter 3.

We do a similar analysis (not tabulated) for changes in net income. This analysis, as in BD, seeks to discern if managers also manage earnings to avoid decreases in earnings from the previous year. The results again indicate earnings management in fiscal year earnings. The deviation from expected frequency in partition -1 is negative (Z-stat. of -6.72) and the deviation from expected frequency in partition 0 is positive (Z-stat. of 4.93). However, somewhat surprisingly, earnings computed for the other annual periods appear to share this property, although to a lesser extent. The deviation from the expected frequency in partition -1 is negative and this deviation in partition 0 is positive for all four annual periods.[12] We conjecture that the reason for this phenomenon is that the distribution of earnings changes has a natural peak immediately to the right of zero (i.e., changes in earnings tend to be slightly positive). BD measure expected frequency as the mean of the frequencies in adjacent partitions. This is a reasonable proxy for expected frequency except near the peak of the distribution.[13]

III.2 Alternate Test for Earnings Management to Meet Thresholds

We exploit the unique features of our research design to construct an alternative measure of the expected frequency in each partition. We compute the expected frequency in each partition of the histogram (expressed as the proportion of the sample in that partition) of fiscal year earnings as the mean of the actual frequencies in the identical partition of the histograms for the three alternative annual periods. We believe that the frequency in the identical partition of the histograms of earnings computed over the alternative annual periods is a natural benchmark for the frequency in the partition for fiscal year earnings. The quarterly earnings aggregated in all four histograms are the same – only the partitioning into annual periods differs. The

[12] However, the deviations are only statistically significant at conventional levels for the fiscal year and the annual period ending in quarter two.

statistical significance of deviations from expected frequency is evaluated using a Z-statistic. We describe this Z-statistic below.

With the same number of firm-year observations, N, for all four possible annual periods, the difference between the actual frequency and expected frequency is:

$$\text{Diff} = p_0^{(4)} - \frac{1}{3}\left\{ p_0^{(1)} + p_0^{(2)} + p_0^{(3)} \right\} \tag{1}$$

where $p_0^{(q)}$ is the proportion of the sample of earnings in annual period ending in quarter q which is in partition 0. Following the line of argument in footnote 6 of BD, the asymptotic variance of Diff is

$$\text{VAR} = N\left[p_0^{(4)}\left(1 - p_0^{(4)}\right) + \frac{1}{9}\left\{ p_0^{(1)}\left(1 - p_0^{(1)}\right) + p_0^{(2)}\left(1 - p_0^{(2)}\right) + p_0^{(3)}\left(1 - p_0^{(3)}\right)\right\}\right] \tag{2}$$

and the test statistic to assess statistical significance of Diff is:

$$\text{Z} = \frac{\sqrt{N}\ \text{Diff}}{\left[p_0^{(4)}\left(1 - p_0^{(4)}\right) + \frac{1}{9}\left\{ p_0^{(1)}\left(1 - p_0^{(1)}\right) + p_0^{(2)}\left(1 - p_0^{(2)}\right) + p_0^{(3)}\left(1 - p_0^{(3)}\right)\right\}\right]} \tag{3}$$

We investigate the properties of this Z-statistic under the null using Monte-Carlo simulations. We generate pseudo-quarterly earnings as series of Gaussian (mean zero, standard deviation one) random numbers of length 40. We aggregate these into annual earnings in the four different ways and assign them to partitions based on their values. We then find the frequency in each partition and the difference between the actual frequency in the pseudo-fiscal year and the expected frequency computed as the mean of the frequencies for annual earnings for annual periods ending in the three other quarters. We then compute the Z-statistic and their associated p-values for the Diff in each partition using the formula in (3). We use these p-values

[13] The alternate measures of expected frequency that BD use, for example, the mean of the frequencies in the four adjacent partitions, two on either side, are also not appropriate near the peak of the distribution.

to find the rejection percentages at the 1%, 5% and 10% levels. We find that the rejection percentages for these simulated Z-statistics (which correspond to the null) are fairly close to their theoretical values.

We also assess how unusual the deviations from expectations around the threshold are using two other metrics which are less dependent on distributional assumptions. First, we calculate the number of consecutive deviations from expected frequency in the neighborhood of the earnings threshold whose sign is consistent with earnings management at the threshold. Second, we compute and report the rank, relative to all partitions, of the absolute value of the Z-statistics for partitions around the threshold, to assess how unusual these Z-statistics are.

The results for earnings scaled by market value of equity at the beginning of the annual period using this alternate expectation are presented in Table 3. The table presents frequencies for the forty partitions surrounding zero. As in Table 2, the lower than expected frequency in the partition to the left of zero (Z of -13.84, highest in absolute value) and the higher than expected frequency in the partition to the right of zero (Z of 8.34, second highest in absolute value), are striking and statistically significant.

It is also noteworthy that indications of earnings management are not confined to the immediate vicinity of zero earnings. In Panel A of Table 3, nine consecutive partitions immediately below zero have lower than expected frequencies. The difference of the actual frequency from the expected is significant at the ten percent level or better for the six partitions immediately below zero. Not all firms in these partitions need to have managed income to achieve the zero threshold. Instead some of these firms, especially those in partitions away from zero, may have engaged in a 'big bath' that moved them further away from the threshold in the current period to increase the probability of achieving the threshold in subsequent periods.

Seven consecutive partitions immediately above zero have higher than expected frequencies.[14] Again, we do not believe that all of the excess frequency in these partitions is due to firms with unmanaged earnings below the zero threshold shifting earnings to achieve this threshold. The model in DPZ suggests that some managers, who have surpassed the threshold, prefer to rein in earnings to increase the probability of achieving the threshold in future periods. The fact that seven consecutive partitions from partition 7 to partition 13 exhibit lower than expected frequencies is consistent with this. Figure 1E plots the deviation from the expected frequency in each partition. The abrupt change from negative deviations to positive deviations at partition zero is striking.

Similar patterns appear in the histogram of earnings changes (not tabulated). The deviation from expected frequency is negative in partition -1 (Z of -5.7, largest in absolute value) and positive in partition 0 (Z of 3.10, sixth largest in absolute value). 19 consecutive partitions immediately below zero have lower than expected frequencies and four consecutive partitions immediately above zero have larger than expected frequencies.[15] Again, earnings management does not appear confined to the immediate vicinity of thresholds. Some of these insights were not apparent in prior research because their focus was on the immediate vicinity of thresholds and because of the research design used in these studies. Figure 2 graphs the deviations of actual from expected frequency for scaled changes in net income. Again, the change at the zero partition from large negative deviations to large positive deviations is striking. It is hard to explain this abrupt change except as a manifestation of earnings management to meet the threshold of the prior periods' earnings.

III.3 Are the discontinuities induced by scaling?

[14] The probability of 9 consecutive negative differences under the null is one in 512. The probability of 7 consecutive positive differences is 1 in 128. The joint probability of getting a sequence of both of these under the null is 1 in 65,536.

[15] The probability of observing this sequence by chance is 1 in 8,388,608.

As mentioned earlier, several recent papers suggest that the discontinuities at zero in the distribution of scaled earnings and earnings changes may be induced by the scaling procedures used. The results we present in Tables 2 and 3 would seem to argue against scaling being primarily responsible for the observed discontinuities. When present, the discontinuities at zero in the distribution of our alternate annual earnings measures, which are scaled similarly to fiscal year earnings, are much smaller in magnitude and usually not statistically significant. However, DE report that firms that report small losses in the fiscal year end are priced differently than firms that report small losses at the end of the other three quarters.[16] This opens up the possibility that our results in Tables 2 and 3 could also be affected by biases associated with scaling. We investigate this possibility by repeating our Table 3 analysis on unscaled net income and EPS.

Figures 3A to 3D graph the distribution of unscaled annual net income for the four annual periods using partitions of width $100,000 (as in DE). It is apparent from the figures that the peak of the distribution of net income is at zero for all four annual periods. The test for a discontinuity in the distribution at zero used in BD and by us in Table 2 uses an expected frequency in a partition which is the mean of the actual frequency in the two neighboring partitions. This test is not appropriate to test for a discontinuity at the peak of the distribution. However, our test in Table 3, which uses the mean of the frequency in the partition for the alternate annual periods, is applicable for any partition including the one that encompasses the peak. We therefore perform this test on unscaled fiscal year net income. The results for the 40 partitions around zero net income are reported in Table 4.

The results in Table 4 do not support the DPZ and DE assertions that the BD results on the discontinuity at zero in earnings are attributable to scaling. Our test indicates a discontinuity at zero in the distribution of unscaled net income. The deviation from expected frequency is

[16] They report no differences in pricing for stocks making small profits. See footnote 32 of DE.

significantly negative in partition -1 (Z-statistic of -12.37, largest in absolute value) and significantly positive in partition 0 (Z-statistic of 8.51, second largest in absolute value). In addition nine consecutive partitions immediately below zero have lower than expected frequencies while six consecutive partitions at and immediately above zero have greater than expected frequencies. The probability of observing this sequence by chance is 1 in 32,768. The tenor of the results is very similar to that reported in Table 3 for net income scaled by market value of equity. Figure 3E graphs the deviations of the actual from expected frequencies for the 100 partitions around zero. Similar to scaled net income, we again observe the abrupt change at zero from large negative to large positive deviations.

We obtain a sense of the pervasiveness of earnings management to avoid reporting losses by aggregating, across partitions, the difference of the actual frequency in the fiscal year from the expected frequency. The sum of these differences for the nine partitions immediately to the left of zero, i.e., -9 to -1 is 0.908 percent. Approximately one percent of the total sample appears to have avoided reporting a small loss for the fiscal year. Some of these firms may have succeeded in achieving the threshold of zero earnings - the sum of the differences between the actual and expected frequencies in partitions 1 to 5 is 0.798. However, a non-trivial proportion appears to have reined in earnings, perhaps to increase the probability of reaching the threshold in subsequent periods.

BD document indications of earnings management in the two partitions on either side of zero. They also examine the pervasiveness of earnings management in other partitions by using the frequency in the equidistant partition on the other side of the peak of the histogram as the benchmark. Since prior research documents that the distribution of earnings is skewed (see Basu, 1995, Givoly and Hayn, 2000, Gu and Wu, 2003), the validity of this procedure is open to some doubt. We believe that our methodology, which does not rely on the earnings distribution being symmetric under the null, is more appropriate. We find indications that earnings

management is fairly widespread - it does not appear to be confined to the immediate vicinity of thresholds. It is also consistent with predictions from models where managers maximize their compensation over several periods by meeting earnings benchmarks through earnings management.

We also perform a similar analysis (not tabulated) on unscaled changes in net income. Again the results do not suggest that scaling is responsible for the discontinuity at zero that BD document. The deviation from the expected frequency is significantly negative in partition -1 (Z statistic of –2.48, seventh highest in absolute value) and significantly positive in partition 0 (Z-statistic of 5.34, highest in absolute value). 11 consecutive partitions immediately below zero have lower than expected frequencies and 17 consecutive partitions at or above zero have greater than expected frequencies.[17] The sum of deviations of the 11 partitions immediately to the left of zero, i.e., partitions labeled -11 through -1 is -0.706 percent. About 0.7 percent of the total sample appears to have avoided falling into the region of a small earnings decrease for the fiscal year, perhaps through earnings management.[18] The results, again, are very similar to those where the change in earnings is scaled by market value of equity.

Overall, the results reported in Table 4 suggest that the discontinuity at zero in the distribution of scaled net income is not an artifact of the scaling mechanism. We find very similar results when we use unscaled net income. It seems likely that these results are related to earnings management to attain earnings thresholds.

III.4 Are there a discontinuities in the distribution of EPS?

DE state that "although the focus of the 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

[17] The probability of observing this sequence under the null is less than 1 in 260 million.

[18] Again, some of these firms may have achieved the threshold of the previous year's earnings while others may have reined in earnings.

press – rather the emphasis is on earnings per share." We therefore focus on the distribution of earnings per share (EPS) in this sub-section.

The evidence on this issue in prior research is mixed. DPZ, using actual EPS data from I/B/E/S find evidence of a discontinuity in the distribution of levels and changes of EPS. On the other hand, DE, using EPS data from COMPUSTAT, find no evidence of such discontinuities. DE contend that, because DPZ use actual EPS as reported in the I/B/E/S database of analysts' forecasts of earnings, there is a selection bias in their sample. Analysts cover a smaller proportion of firms reporting small losses than those reporting small profits and this coverage is reflected in the I/B/E/S database.

We re-examine this question using our benchmark for the frequency in a partition of the fiscal year EPS as the mean of the frequencies in the identical partition of EPS in the other three annual periods. The EPS data we use is from data item number 27 in the COMPUSTAT quarterly database which represents primary earnings per share, excluding extraordinary items, applicable to the last 12-month period. At year-end, this figure is identical to the fiscal year EPS reported to shareholders. At the end of interim quarters, this figure is approximately the sum of the last four quarterly primary EPS numbers.[19] We find a significantly larger number of cases where this variable is missing in the first three quarters of the fiscal year than where it is missing for the fiscal year. To avoid any biases induced by data availability we restrict our sample to firm-years where this data item is available for all four quarters of the year. The analysis is conducted on EPS rounded to the nearest cent.

We again use the mean of the observed frequency in the identical partition for the other three annual periods as the expected frequency in the partition for fiscal year EPS. We report results for this test for discontinuities in EPS in Table 5. The results of this test are similar to those reported for unscaled net income and for net income scaled by market value of equity with

[19] In their analysis, DE use diluted earnings per share but report that they get similar results when they use primary earnings per share.

the following exception. While in the other cases, there was evidence of a discontinuity at partition zero, in the case of EPS, the discontinuity appears to be shifted by one partition to partition 1. In fact partition 0 has a lower than expected frequency (Z is -4.55, fourth largest in absolute magnitude).[20] Partition 1 has higher than expected frequency (Z of 6.85, highest in absolute magnitude). The incentive appears to be to report positive EPS rather than just non-negative EPS. 9 consecutive partitions, beginning with partition -8, have lower than expected frequencies and 6 consecutive partitions beginning with partition 1 have higher than expected frequencies.[21] Figure 4 graphs the deviations of the actual frequencies from the expected for the 100 partitions around zero EPS. The change from large negative deviations to large positive deviations that we observed for net income is also apparent in this graph. The major difference is that the positive deviations start at an EPS of one cent rather than at zero.

We also perform a similar analysis (not tabulated) on changes in primary EPS. Again, the sample is restricted to firm-years where this variable is available for all four quarters of the fiscal year. This test investigates earnings management to avoid decreases in fiscal year EPS from the previous year. There are significantly fewer than expected decreases of one cent in fiscal year EPS from the previous year (Z-statistic of -5.91, largest in absolute magnitude) and significantly more instances than expected where fiscal year EPS just met the threshold of the previous year's EPS (Z statistic of 4.16, second largest in absolute magnitude). Fourteen consecutive partitions immediately below zero had lower than expected frequencies and three consecutive partitions including and greater than zero had higher than expected frequencies.[22] Consistent with DPZ but not with DE, this is indicative of earnings management to meet the

[20] We conjecture that the shifting of the discontinuity, relative to that for unscaled net income could be attributable to two reasons. First, the EPS number we use excludes the effect of extraordinary items while net income includes them. We are constrained to use this EPS number because it is the only one Compustat reports for annual periods other than the fiscal year. Second, scaling by weighted average shares outstanding in computing EPS could induce some changes in the distribution.

[21] The probability of this sequence under the null is 1 in 32,768.

[22] The probability of observing this sequence under the null is one in 131,072.

threshold of the previous year's EPS.[23] Because our data is extracted from COMPUSTAT, it is not affected by selection biases associated with analyst following.

III.5 Is the discontinuity due to the asymmetric tax treatment of profits and losses?

Beaver, McNichols and Nelson (2003) suggest that, because of restrictions on tax refunds for loss firms, the taxes associated with profits are proportionately higher than the tax savings associated with losses. Small profits are therefore taxed differently than small losses. They argue that this asymmetric tax treatment can explain a substantial proportion of the discontinuity at zero in scaled net income. While we do not directly test this assertion, we test one of its implications. If a considerable portion of the discontinuity in net income is attributable to tax effects, the discontinuity at zero in pre-tax income should be perceptibly smaller. Beaver, McNichols and Nelson (2003) test this implication for pre-tax income scaled by market value of equity at the beginning of the year and find that the magnitude of the discontinuity is substantially reduced compared with the discontinuity in similarly scaled net income. However, DE argue that scaling by market value of equity distorts the distribution and introduces selection biases. We therefore conduct our analysis on unscaled pre-tax income.

We perform our alternate test based on deviations of the fiscal year frequency in each partition from the mean of the frequencies in the identical partition for the other three annual periods on unscaled pre-tax income. The results (not tabulated) are very similar to those for net income. Again, the actual frequency in partition -1 for fiscal year earnings is significantly lower than expected (Z=-9.14, largest in absolute value) and the actual frequency in partition 0 is significantly higher than expected (Z=6.71, second largest in absolute value). Three consecutive partitions below zero have lower than expected frequency and eight consecutive partitions including and above zero have higher than expected frequencies.[24] The magnitudes of the

[23] DE, in their tests, do not find discontinuities at zero in the histograms of unscaled net income and EPS and in the histograms of changes in these variables. It is possible that our test, which uses the histograms of the alternate annual periods, is more powerful.

[24] Probability of observing this sequence under the null is one in 2,048.

deviations from the expected are somewhat smaller than was the case for net income. A possible explanation why the discontinuity in pre-tax income is smaller is that pre-tax income excludes the effects of discontinued operations and extra-ordinary items. If managers use these excluded items strategically to meet earnings targets, pre-tax income may not exhibit discontinuities at these targets to the same extent as net income. Nevertheless it is clear that a substantial proportion of the discontinuity at zero in the histogram of net income is also present in the histogram of pre-tax income. Figure 5 graphs the deviation of actual from expected frequency for the 100 partitions around zero for pre-tax income. The change at zero from large negative deviations to large positive ones that we observed for net income is also apparent in this graph. These results seem to indicate that the asymmetric tax treatment of gains and losses is not primarily responsible for the discontinuity at zero in net income.

For completeness, we also perform a similar analysis (not tabulated) on changes in pre-tax income. In contrast to the case for net income, matching the previous year's pre-tax income is unlikely to be an important target for managers. Not surprisingly therefore, the evidence of a discontinuity in this case is not as strong as for other thresholds. The frequency of observations for fiscal year changes in pre-tax income in partition 0 is considerably higher than expected (Z statistic of 3.81, largest in absolute value). However, the deviation of actual from expected frequency in partition -1 is not significantly different from zero (Z-statistic of -0.66).

IV. Conclusions

In this paper, we aggregate quarterly earnings over annual periods that differ from the fiscal year and compare the properties of these alternative annual earnings with those of fiscal year earnings. This research design enables us to explore issues associated with earnings management using each individual firm as its own control. A persistent problem that has faced researchers investigating earnings management is estimating what earnings would have been in

the absence of earnings management. We view our measures of earnings for the alternative annual periods serve as a reasonable proxy for this in testing for discontinuities in earnings distributions.

Using our framework, we investigate several questions related to the debate over whether the results in BD about discontinuities in earnings and earnings change histograms are evidence of earnings management or whether they are spuriously induced by the research design. Our results generally validate the BD findings and indicate that their results are not spuriously induced by scaling. They also indicate that, for the most part, the BD results cannot be attributed to the asymmetric tax treatment of gains and losses. Earnings management to attain thresholds appears to be the most likely reason. Further, we document that earnings management is not confined to the immediate vicinity of earnings thresholds but is discernible over broader sections of earnings and earnings change histograms.[25]

Our conclusions differ from those in DE. They find no evidence of a discontinuity at zero in unscaled net income or EPS. We conjecture that differences in our results may be due to differing methodologies to test for discontinuities in distributions. It is possible that our methodology is more powerful in testing for earnings management. Our findings suggest that while scaling and associated selection biases might contribute to the discontinuity they do not entirely explain the discontinuities.

We introduce a new test for the significance of differences of actual from expected frequency in partitions of histograms of annual earnings and earnings changes. This test can be used in any partition of the histogram including at the peak of the distribution. Since the histograms of many accounting variables of interest such as net income, EPS and changes in these variables have a natural peak at zero, this should aid future researchers investigating discontinuities in these variables. This paper contributes to the methodology pioneered by Hayn

[25] Since we always aggregate across four quarters and include one fourth quarter in each aggregation, at least one quarter in every annual period is audited. Consequently, we do not believe that our major results are driven by differences in the audit quality of the last quarter of the fiscal year compared to the other three quarters.

(1995) and BD to test for earnings management. Their methodology has been used in numerous subsequent papers and it seems likely that it will continue to be used.

Our methodology does have some limitations. To the extent that quarterly earnings and earnings for our alternate annual periods are also managed, noise may be introduced into the analysis. We expect that this phenomenon would bias our tests towards the null by making deviations from expected frequency smaller in absolute magnitude. To the extent that we find significant discontinuities despite this, it is stronger evidence that the discontinuities exist. However, the noise introduced by management of interim earnings could be more of a problem in other contexts. A second possible limitation is that the sum of the negative deviations in the partitions below and in the neighborhood of the threshold oftentimes does not exactly equal the sum of positive deviations in the partitions above and in the neighborhood of the threshold. A possible reason is that earnings management, for example through a big bath, might cause observations to be shifted to partitions out of the immediate neighborhood of a threshold. Similarly, reining in of earnings might cause observations from outside the immediate neighborhood of the threshold to be moved to within the threshold. Alternatively, in the analyses of scaled earnings and especially scaled earnings changes where this inequality is most apparent, scaling might introduce distortions in the distribution as DE suggest.

Although we have only used it the specific context of examining for discontinuities in earnings distributions, we believe that the methodology has broader applicability, especially as a measure of earnings management. A natural extension would be to explore the properties of the components of earnings – cash flows and accruals, or revenues and expenses. For instance, the methodology might be used to investigate whether the timing of discretionary expenditures such as that for R&D is affected by earnings management incentives. Furthermore, a similar study on non-U.S. firms disclosing interim earning might reveal whether the degree of managerial discretion varies due to, for example, some countries allowing for more, or less, flexibility in

financial reporting. For example, it is possible that earnings from firms in countries with more book-tax conformity are less likely to exhibit these patterns.

Our results also have implications for investors and analysts. They suggest that investors and analysts can use quarterly data to unravel part of managers' earnings management in fiscal year earnings by choosing to analyze firm performance reported on a different annual basis than the one reported in the annual financial statements.

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Table 1: Example of Aggregation of Net Income for Alternative Annual Periods

Fiscal year	Fiscal quarter	Quarterly earnings (in million $s)	Earnings for annual period ending in quarter (in million $s)
1999	1	1,470	
1999	2	2,391	
1999	3	1,762	
1999	4	2,089	**7,712**
2000	1	1,519	7,761
2000	2	1,941	7,311
2000	3	1,963	7,512
2000	4	2,670	**8,093**
2001	1	1,750	8,324
2001	2	2,045	8,428
2001	3	1,595	8,060
2001	4	2,333	**7,723**

Notes to Table 1:
This table presents IBM's quarterly earnings for the years 1999-2001 and illustrates the computation of annual earnings over periods ending at each of the four quarters. Bolded numbers are fiscal year annual earnings.

Table 2:
Frequency Distribution of Market Value Deflated Net Income

Partition	Annual period ending in fiscal year quarter											
	Four			One			Two			Three		
	Freq. (%)	Freq.-Exp. Freq	Z-stat	Freq. (%)	Freq.-Exp. Freq	Z-stat	Freq (%)	Freq.-Exp. Freq	Z-stat	Freq. (%)	Freq.-Exp. Freq	Z-stat
-20	0.488	-0.014	-0.56	0.506	0.016	0.66	0.499	-0.022	-0.85	0.519	0.014	0.52
-19	0.521	0.035	1.40	0.508	-0.007	-0.27	0.533	0.023	0.88	0.528	-0.012	-0.45
-18	0.483	-0.037	-1.50	0.523	-0.009	-0.36	0.520	-0.018	-0.70	0.561	0.017	0.62
-17	0.520	0.018	0.69	0.557	0.024	0.92	0.545	-0.010	-0.39	0.560	0.011	0.39
-16	0.522	-0.007	-0.28	0.543	-0.021	-0.79	0.590	-0.002	-0.08	0.538	-0.063	-2.35
-15	0.538	-0.019	-0.72	0.570	-0.013	-0.47	0.640	0.057	2.00	0.643	0.066	2.31
-14	0.591	0.024	0.89	0.622	0.011	0.38	0.576	-0.051	-1.84	0.616	-0.008	-0.28
-13	0.597	-0.037	-1.34	0.654	-0.003	-0.12	0.614	-0.014	-0.49	0.606	-0.038	-1.36
-12	0.677	0.055	1.92	0.692	0.017	0.59	0.680	0.051	1.75	0.672	0.020	0.67
-11	0.647	-0.052	-1.82	0.695	0.006	0.20	0.644	-0.066	-2.24	0.700	0.028	0.93
-10	0.721	0.065	2.19	0.687	-0.047	-1.57	0.739	0.040	1.29	0.671	-0.060	-2.01
-9	0.667	-0.066	-2.25	0.771	0.052	1.69	0.754	-0.012	-0.39	0.763	0.068	2.20
-8	0.744	0.027	0.89	0.752	-0.033	-1.07	0.794	0.004	0.14	0.718	-0.067	-2.17
-7	0.767	0.011	0.37	0.798	-0.008	-0.24	0.826	0.023	0.70	0.808	0.011	0.35
-6	0.768	-0.016	-0.51	0.860	0.033	1.00	0.812	-0.058	-1.78	0.875	0.033	0.99
-5	0.801	-0.005	-0.17	0.857	-0.006	-0.19	0.914	0.029	0.85	0.876	-0.010	-0.28
-4	0.844	0.033	1.02	0.866	-0.036	-1.10	0.959	-0.010	-0.30	0.896	-0.044	-1.27
-3	0.823	0.017	0.53	0.948	0.026	0.75	1.024	0.054	1.51	1.004	0.058	1.63
-2	0.767	0.019	0.61	0.978	0.000	-0.01	0.981	-0.084	-2.33	0.995	-0.024	-0.68
-1	**0.674**	**-0.447**	**-14.00**	**1.010**	**-0.072**	**-2.01**	**1.105**	**0.048**	**1.29**	**1.035**	**-0.038**	**-1.04**
0	**1.476**	**0.445**	**10.99**	**1.185**	**0.062**	**1.62**	**1.133**	**-0.031**	**-0.81**	**1.153**	**0.013**	**0.34**
1	1.387	-0.053	-1.27	1.238	-0.042	-1.06	1.222	-0.053	-1.32	1.243	-0.004	-0.10
2	1.404	-0.058	-1.39	1.374	0.030	0.74	1.417	0.052	1.22	1.342	-0.008	-0.20
3	1.537	0.035	0.80	1.449	-0.019	-0.44	1.509	-0.011	-0.26	1.458	0.001	0.03
4	1.601	-0.046	-1.02	1.562	-0.023	-0.52	1.623	-0.032	-0.70	1.571	-0.019	-0.42
5	1.756	-0.001	-0.02	1.720	0.005	0.12	1.801	0.035	0.73	1.721	0.001	0.03
6	1.912	0.033	0.69	1.867	-0.031	-0.64	1.910	-0.070	-1.40	1.869	-0.049	-1.01
7	2.003	-0.069	-1.39	2.076	0.013	0.26	2.158	0.057	1.09	2.115	0.046	0.90
8	2.232	0.035	0.68	2.259	-0.001	-0.02	2.292	-0.024	-0.45	2.269	0.024	0.46
9	2.390	0.017	0.32	2.444	0.047	0.85	2.475	0.003	0.05	2.374	-0.006	-0.11
10	2.514	-0.044	-0.79	2.536	-0.041	-0.73	2.652	0.030	0.52	2.491	-0.081	-1.43
11	2.726	0.104	1.83	2.709	0.055	0.96	2.770	0.033	0.57	2.770	0.122	2.08
12	2.729	-0.015	-0.25	2.773	0.020	0.34	2.820	-0.008	-0.14	2.804	0.028	0.46
13	2.762	0.022	0.38	2.796	0.072	1.23	2.887	0.078	1.30	2.783	0.024	0.41
14	2.750	0.058	1.01	2.676	-0.030	-0.52	2.798	0.070	1.18	2.713	0.022	0.38
15	2.622	0.040	0.71	2.616	0.066	1.17	2.570	-0.056	-0.98	2.599	0.020	0.34
16	2.413	-0.077	-1.42	2.424	-0.069	-1.26	2.454	-0.008	-0.14	2.445	-0.047	-0.84
17	2.359	0.085	1.60	2.370	0.114	2.12	2.353	0.051	0.94	2.385	0.072	1.32
18	2.134	0.003	0.05	2.089	-0.092	-1.80	2.150	-0.032	-0.62	2.180	0.002	0.03
19	1.905	-0.071	-1.46	1.991	0.055	1.11	2.012	0.060	1.18	1.972	0.017	0.33

Notes to Table 2:

Earnings were deflated by market value of equity as of the beginning of the year. The expected frequency is computed as the mean of the frequency in the two adjacent partitions. For the sake of brevity, only partitions with earnings scaled by market capitalization ranging from -10% to 10% are presented in the table. The frequencies, in both panels, are expressed as percentages of the total sample. The Z-statistics are computed using the formula described in footnote 6 of Burgstahler and Dichev (1997).

Table 3:
Expected and Actual Frequency of Fiscal Year Net Income
Scaled by Market Value of Equity
(Using average of other annual periods as expectation)

Partition	Frequency for fiscal year (%)	Average frequency for other three annual periods	Difference	Z-statistic for difference
-20	0.488	0.508	-0.020	-0.87
-19	0.521	0.523	-0.002	-0.08
-18	0.483	0.535	-0.051	-2.27
-17	0.520	0.554	-0.034	-1.44
-16	0.522	0.557	-0.035	-1.49
-15	0.538	0.617	-0.080	-3.31
-14	0.591	0.605	-0.014	-0.55
-13	0.597	0.625	-0.027	-1.10
-12	0.677	0.682	-0.005	-0.18
-11	0.647	0.679	-0.033	-1.26
-10	0.721	0.699	0.023	0.83
-9	0.667	0.763	-0.096	-3.60
-8	0.744	0.755	-0.011	-0.39
-7	0.767	0.811	-0.043	-1.53
-6	0.768	0.849	-0.081	-2.84
-5	0.801	0.882	-0.082	-2.80
-4	0.844	0.907	-0.063	-2.10
-3	0.823	0.992	-0.169	-5.67
-2	0.767	0.985	-0.217	-7.50
-1	**0.674**	**1.050**	**-0.376**	**-13.48**
0	**1.476**	**1.157**	**0.319**	**8.34**
1	1.387	1.235	0.153	4.07
2	1.404	1.378	0.026	0.68
3	1.537	1.472	0.065	1.64
4	1.601	1.585	0.016	0.39
5	1.756	1.747	0.008	0.20
6	1.912	1.882	0.031	0.69
7	2.003	2.116	-0.113	-2.49
8	2.232	2.273	-0.042	-0.87
9	2.390	2.431	-0.041	-0.83
10	2.514	2.560	-0.046	-0.90
11	2.726	2.750	-0.024	-0.45
12	2.729	2.799	-0.070	-1.32
13	2.762	2.822	-0.060	-1.14
14	2.750	2.729	0.021	0.39
15	2.622	2.595	0.027	0.52
16	2.413	2.441	-0.028	-0.56
17	2.359	2.369	-0.010	-0.21
18	2.134	2.140	-0.005	-0.11
19	1.905	1.992	-0.087	-1.95

Notes to Table 3:

Net income was deflated by market value of equity as of the beginning of the year. The partitions are of width 0.005 of market value of equity. Only partitions with scaled earnings ranging from -10% to 10% are presented for the sake of brevity.

The frequencies are expressed as percentages of the total sample. The mean of the frequency in the same partition for the alternative annual periods was used as the expected frequency. The Z-statistics are computed using the formula in equation (3) in the paper.

Table 4:
Expected and Actual Frequency of Fiscal Year Net Income (unscaled)
(Using average of other annual periods as expectation)

Partition	Frequency for fiscal year (%)	Average frequency for other three annual periods	Difference	Z-statistic for difference
-20	0.389	0.379	0.009	0.51
-19	0.415	0.397	0.018	0.94
-18	0.397	0.413	-0.015	-0.83
-17	0.379	0.444	-0.065	-3.49
-16	0.435	0.445	-0.009	-0.48
-15	0.468	0.471	- 0.003	-0.15
-14	0.506	0.497	0.008	0.40
-13	0.521	0.522	-0.001	-0.04
-12	0.584	0.551	0.033	1.49
-11	0.547	0.609	-0.061	-2.78
-10	0.702	0.677	0.025	1.03
-9	0.714	0.727	-0.013	-0.53
-8	0.731	0.787	-0.056	-2.19
-7	0.791	0.820	-0.029	-1.11
-6	0.847	0.911	-0.064	-2.34
-5	0.939	0.972	-0.033	-1.16
-4	1.027	1.098	-0.071	-2.37
-3	1.099	1.206	-0.107	-3.43
-2	1.164	1.377	-0.213	-6.58
-1	**1.079**	**1.472**	**-0.393**	**-12.37**
0	**1.901**	**1.566**	**0.335**	**8.51**
1	1.493	1.349	0.144	4.09
2	1.358	1.260	0.098	2.89
3	1.266	1.152	0.114	3.50
4	1.098	1.038	0.060	1.96
5	1.011	0.964	0.047	1.59
6	0.861	0.888	-0.027	-0.98
7	0.870	0.845	0.025	0.923
8	0.856	0.775	0.081	3.02
9	0.680	0.749	-0.068	-2.77
10	0.823	0.705	0.118	4.52
11	0.723	0.697	0.026	1.05
12	0.696	0.648	0.048	1.99
13	0.636	0.652	-0.016	-0.67
14	0.615	0.614	0.001	0.02
15	0.611	0.586	0.025	1.10
16	0.543	0.581	-0.038	-1.74
17	0.530	0.534	-0.004	-0.21
18	0.526	0.517	0.009	0.42
19	0.457	0.477	-0.020	-1.02

Notes to Table 4:

The partitions are of width $100,000. Only partitions with net income from -$2,000,000 to $2,000,000 are presented, for the sake of brevity.

The frequencies are expressed as percentages of the total sample. The mean of the frequency in the same partition for the alternative annual periods was used as the expected frequency. The Z-statistics are computed using the formula in equation (3) in the paper.

Table 5:
Expected and Actual Frequency of Fiscal Year Basic Earnings Per Share
(Using average of other annual periods as expectation)

Partition	Frequency for fiscal year (%)	Average frequency for other three annual periods	Difference	Z-statistic for difference
-20	0.340	0.341	-0.001	- 0.05
-19	0.363	0.347	0.016	0.86
-18	0.353	0.364	-0.012	-0.63
-17	0.353	0.388	-0.035	-1.90
-16	0.369	0.396	-0.027	-1.44
-15	0.377	0.411	- 0.034	-1.74
-14	0.417	0.436	-0.019	-0.95
-13	0.428	0.449	-0.020	-1.00
-12	0.483	0.470	0.013	0.59
-11	0.476	0.471	0.005	0.25
-10	0.462	0.506	-0.043	-2.02
-9	0.527	0.527	0.000	0.00
-8	0.539	0.576	-0.037	-1.63
-7	0.513	0.594	-0.081	-3.56
-6	0.593	0.631	-0.038	-1.63
-5	0.653	0.679	-0.026	-1.03
-4	0.688	0.749	-0.061	-2.35
-3	0.694	0.809	-0.115	-4.35
-2	0.856	0.926	-0.070	-2.42
-1	**1.074**	**1.088**	**-0.014**	**-0.42**
0	**1.447**	**1.619**	**-0.172**	**-4.55**
1	0.995	0.789	0.206	6.85
2	0.863	0.698	0.165	5.88
3	0.683	0.642	0.041	1.62
4	0.631	0.587	0.044	1.81
5	0.556	0.550	0.007	0.28
6	0.557	0.517	0.041	1.77
7	0.507	0.509	-0.002	-0.08
8	0.477	0.470	0.008	0.35
9	0.477	0.472	0.005	0.25
10	0.491	0.464	0.027	1.26
11	0.435	0.424	0.011	0.55
12	0.455	0.441	0.015	0.70
13	0.402	0.397	0.005	0.28
14	0.382	0.408	-0.027	-1.38
15	0.390	0.384	0.005	0.28
16	0.417	0.383	0.034	1.71
17	0.358	0.362	-0.004	-0.21
18	0.369	0.366	0.003	0.17
19	0.335	0.369	-0.034	-1.87

Notes to Table 5:

EPS is defined as primary earnings per share, excluding extraordinary items, applicable to the last 12-month period (data item number 27 in the quarterly COMPUSTAT database). The partitions are of width one cent each. EPS has been rounded to the nearest cent. Only partitions with EPS ranging from -20 cents to 20 cents are presented, for the sake of brevity. The frequencies are expressed as percentages of the total sample. The mean of the frequency in the same partition for the alternative annual periods was used as the expected frequency. The Z-statistics are computed using the formula in equation (3) in the paper.

Figure 1A: Fiscal Year Scaled Net Income

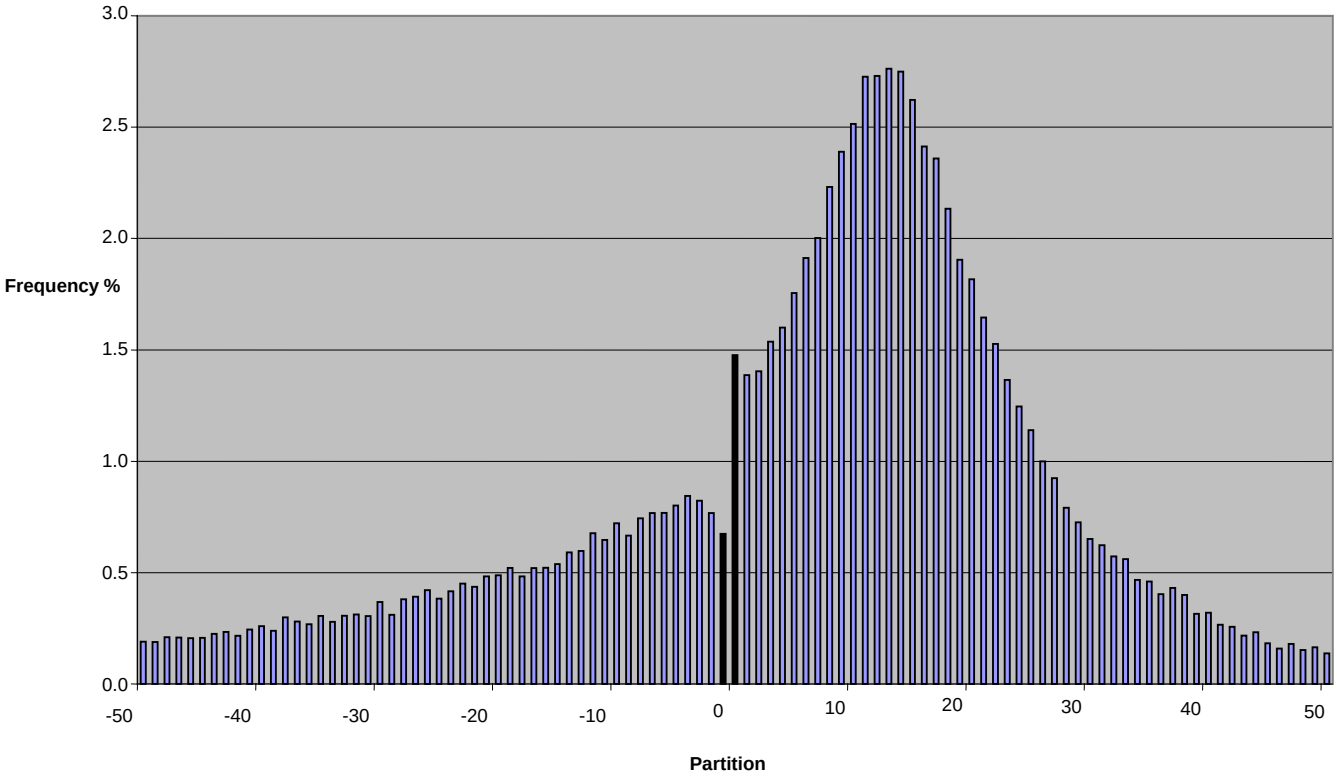

Figure 1B: Scaled Net Income for Annual Period Ending in Quarter One

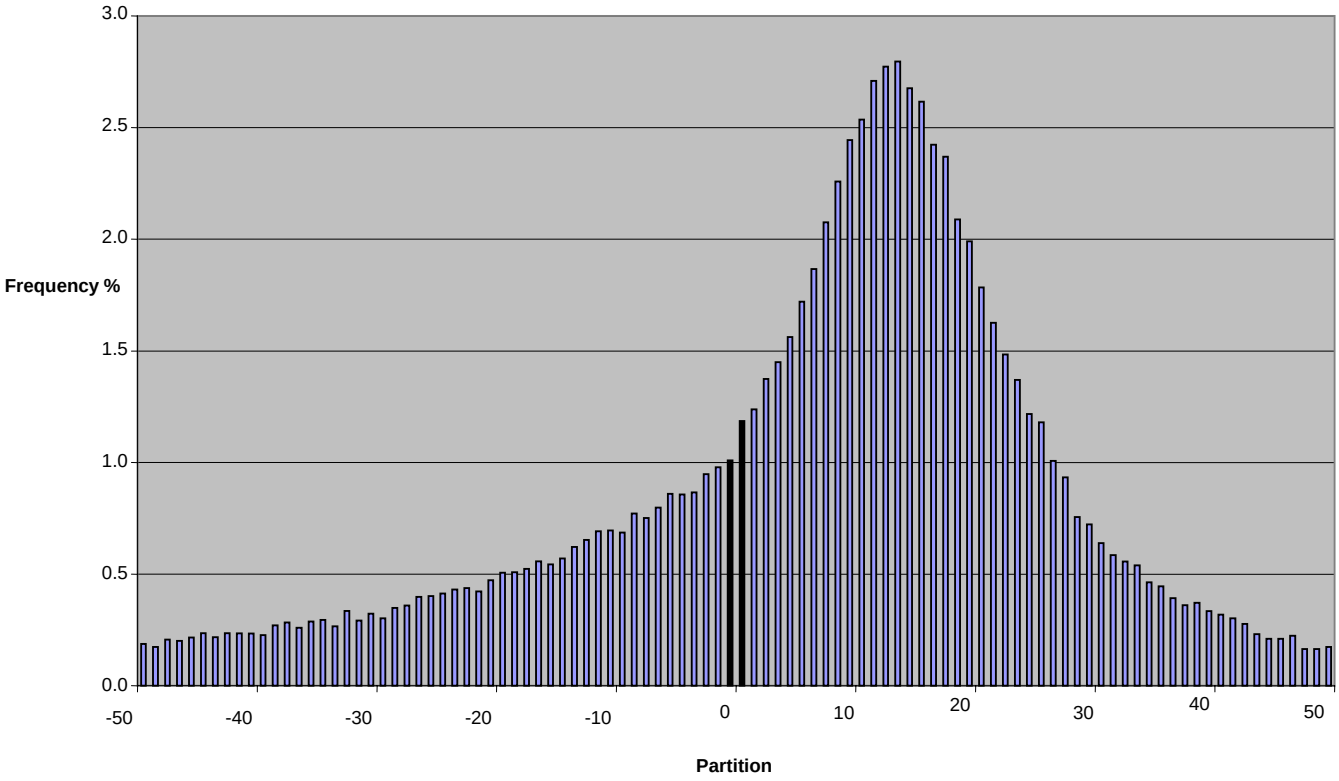

Figure 1C: Scaled Net Income for Annual Period Ending in Quarter Two

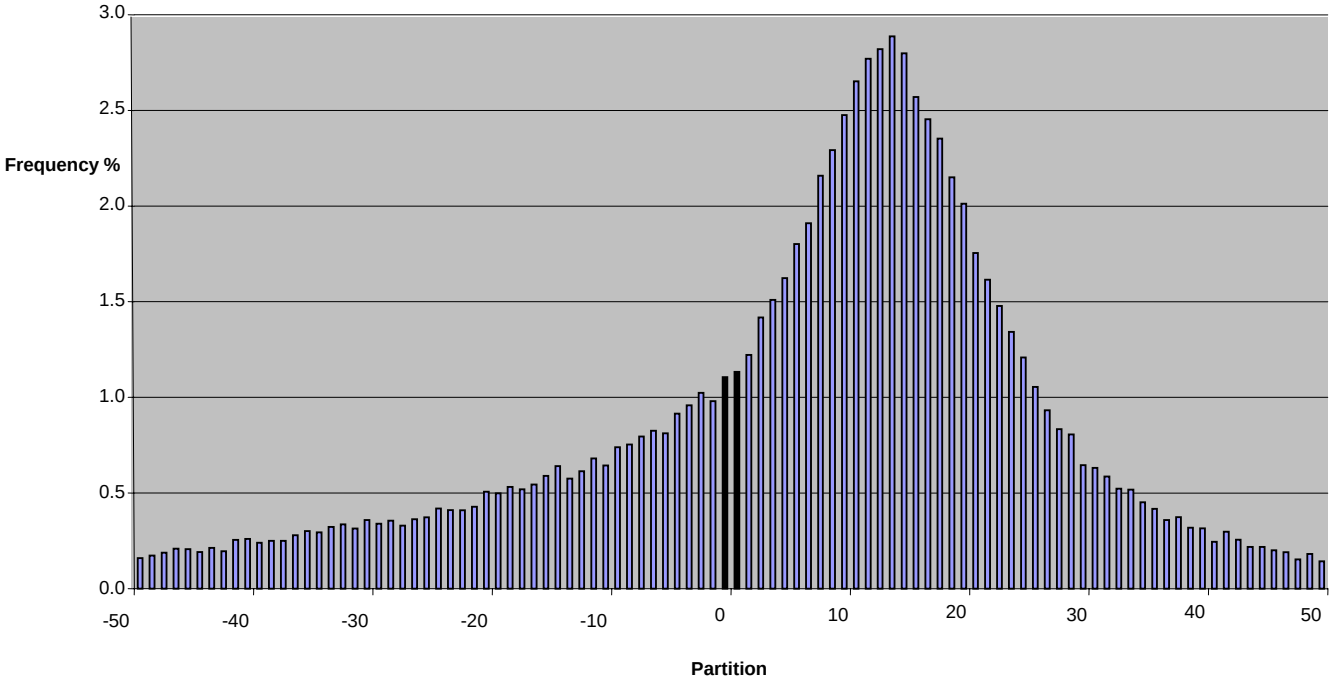

Figure 1D: Scaled Net Income for Annual Period Ending in Quarter Three

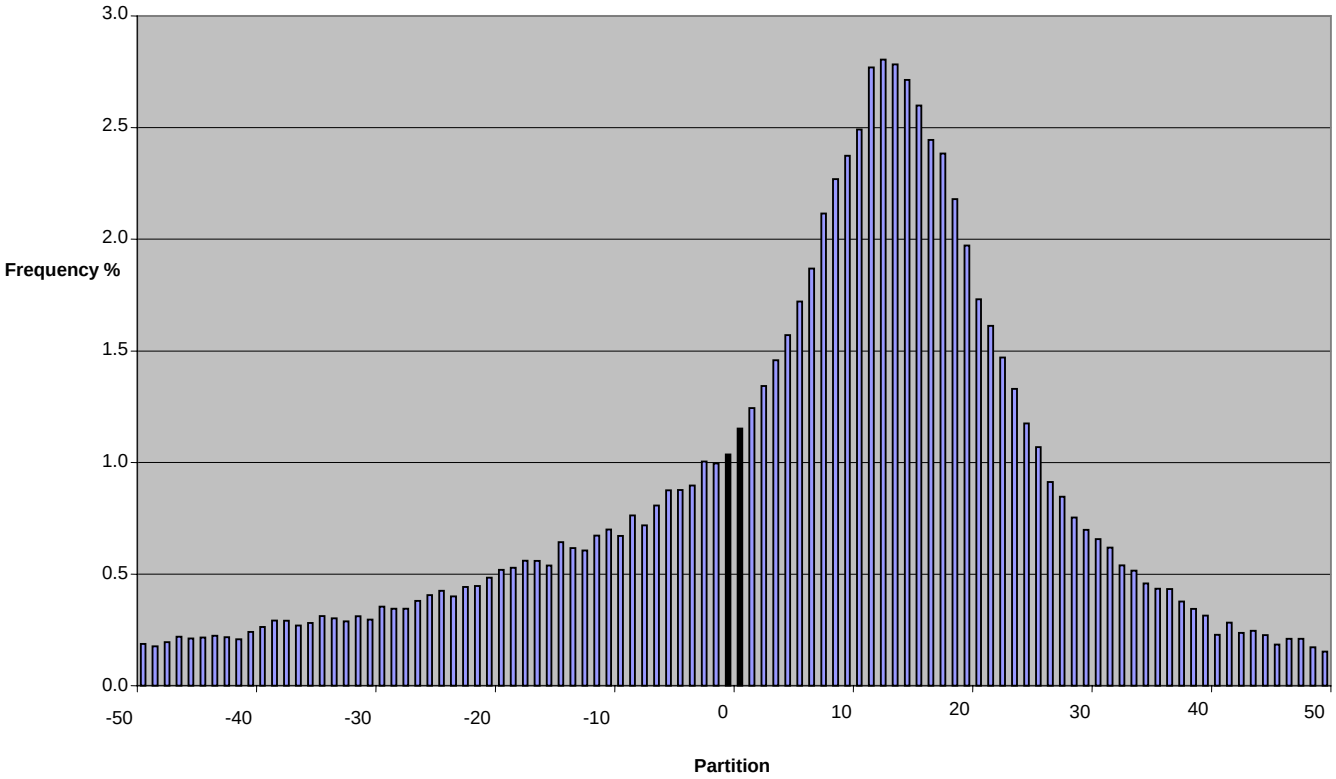

Figure 1E: Difference between Actual and Expected Frequency of Scaled Net Income

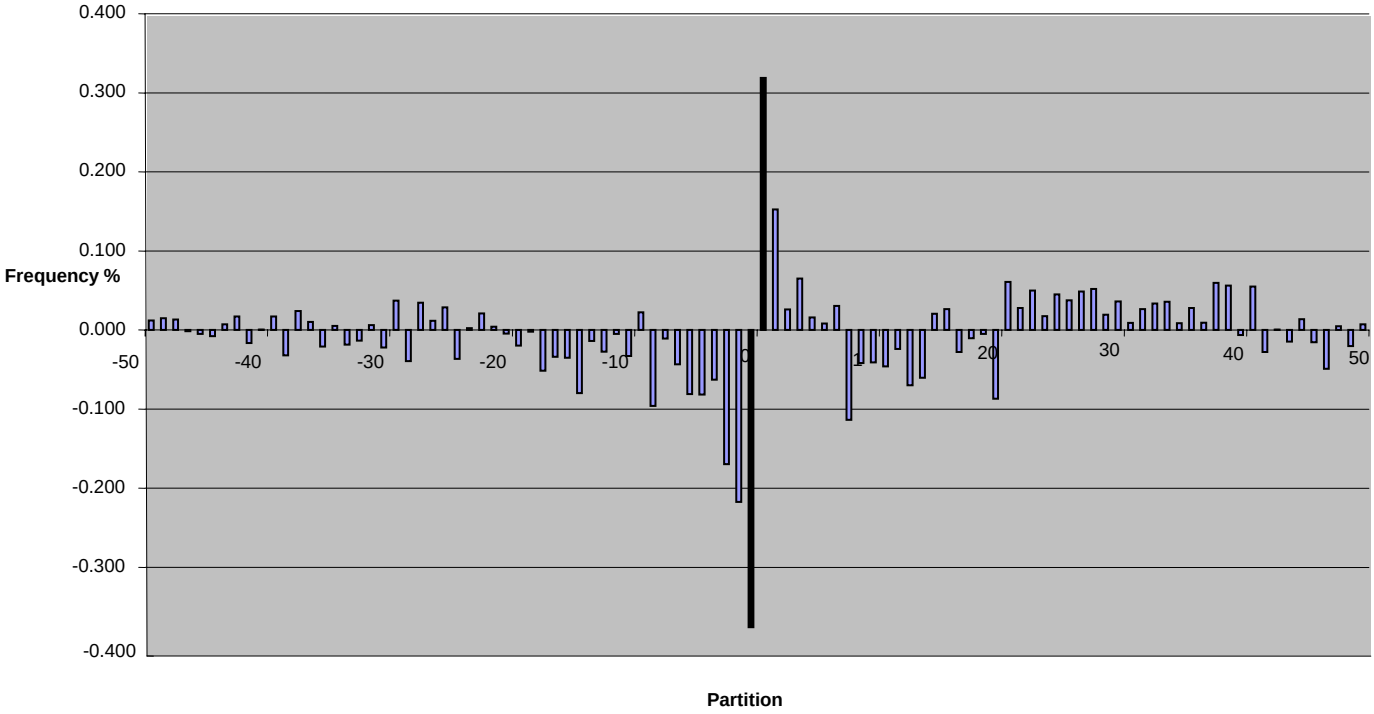

Figure 1:

Figure 1 illustrates the effect of the annual measurement period on net income scaled by market value of equity at the beginning of the year. Partitions 0 and 1 have been darkened to make them easier to identify.

Figure 1A is the histogram of fiscal year scaled net income. Figure 1B is the histogram of scaled net income for the annual period ending at the close of the first fiscal quarter. Figure 1C is the histogram of scaled net income for the annual period ending at the close of the second fiscal quarter. Figure 1D is the histogram of scaled net income for the annual period ending at the close of the third fiscal quarter. Figure 1E represents the differences in each partition between the fiscal year histogram in figure 1A and an equally weighted average of the histograms in figures 1B, 1C, and 1D.

Figure 2: Difference between Actual and Expected Frequencies for Fiscal Year Scaled Changes in Net Income

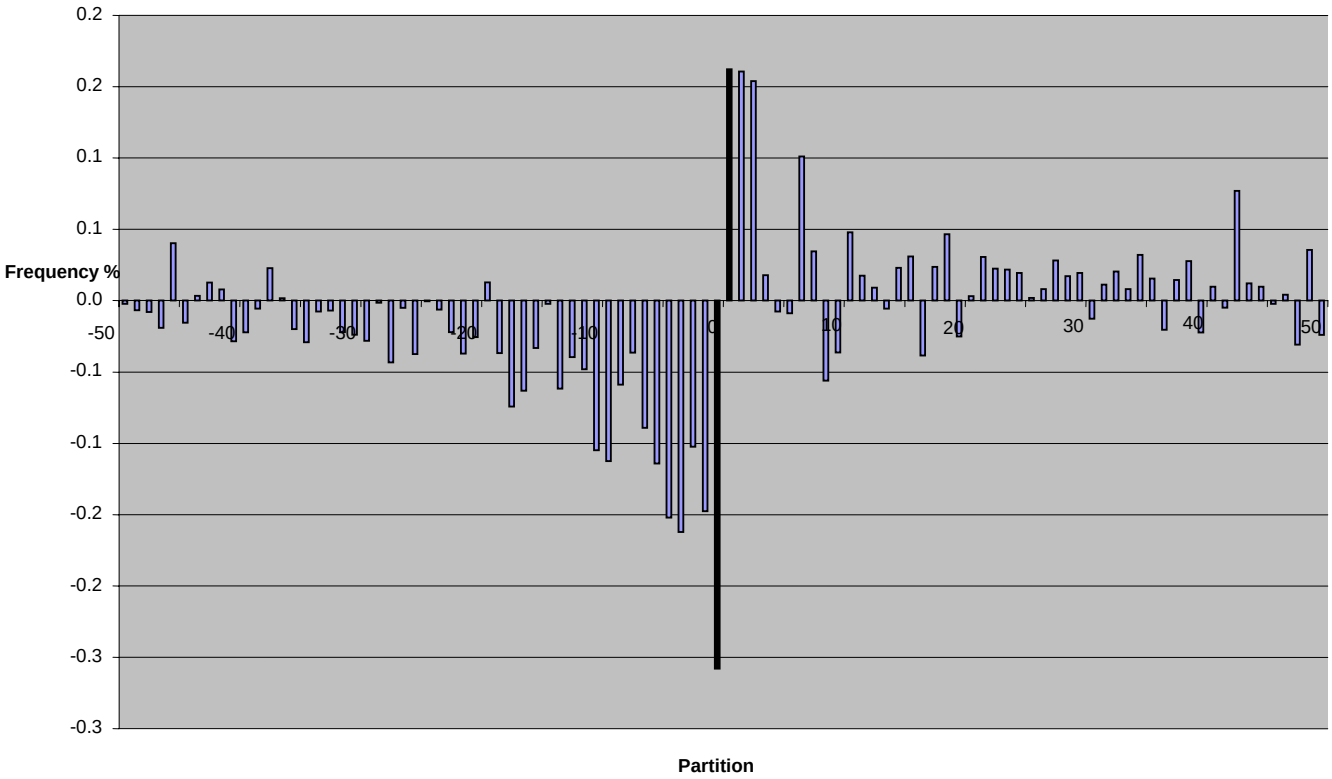

Figure 2 presents the differences in frequencies of changes in scaled earnings between the fiscal year and the mean of the other three annual periods. Partitions 0 and 1 have been darkened to make them easier to identify.

Figure 3A: Unscaled Fiscal Year Net Income

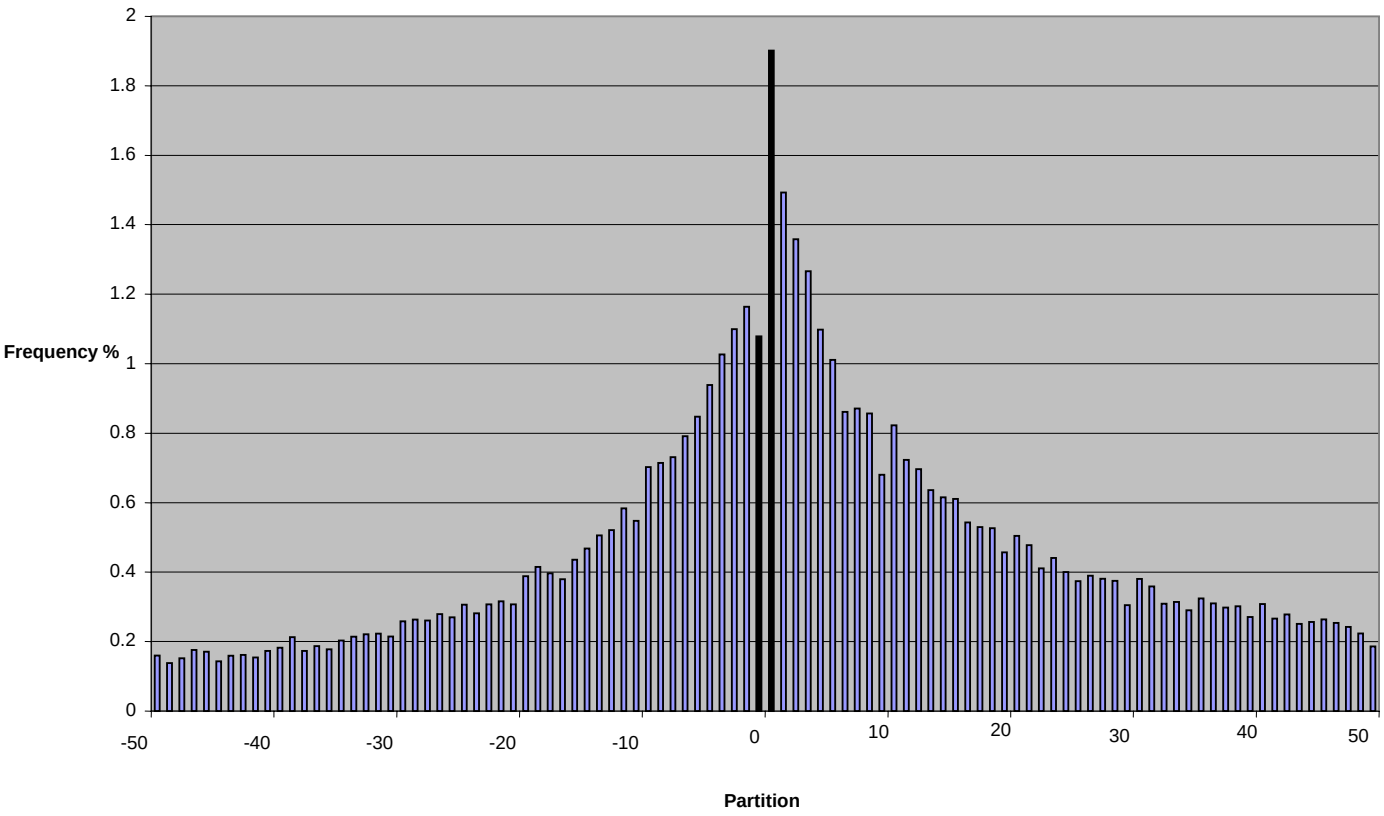

Figure 3B: Unscaled Net Income: Annual Period Ending in Quarter One

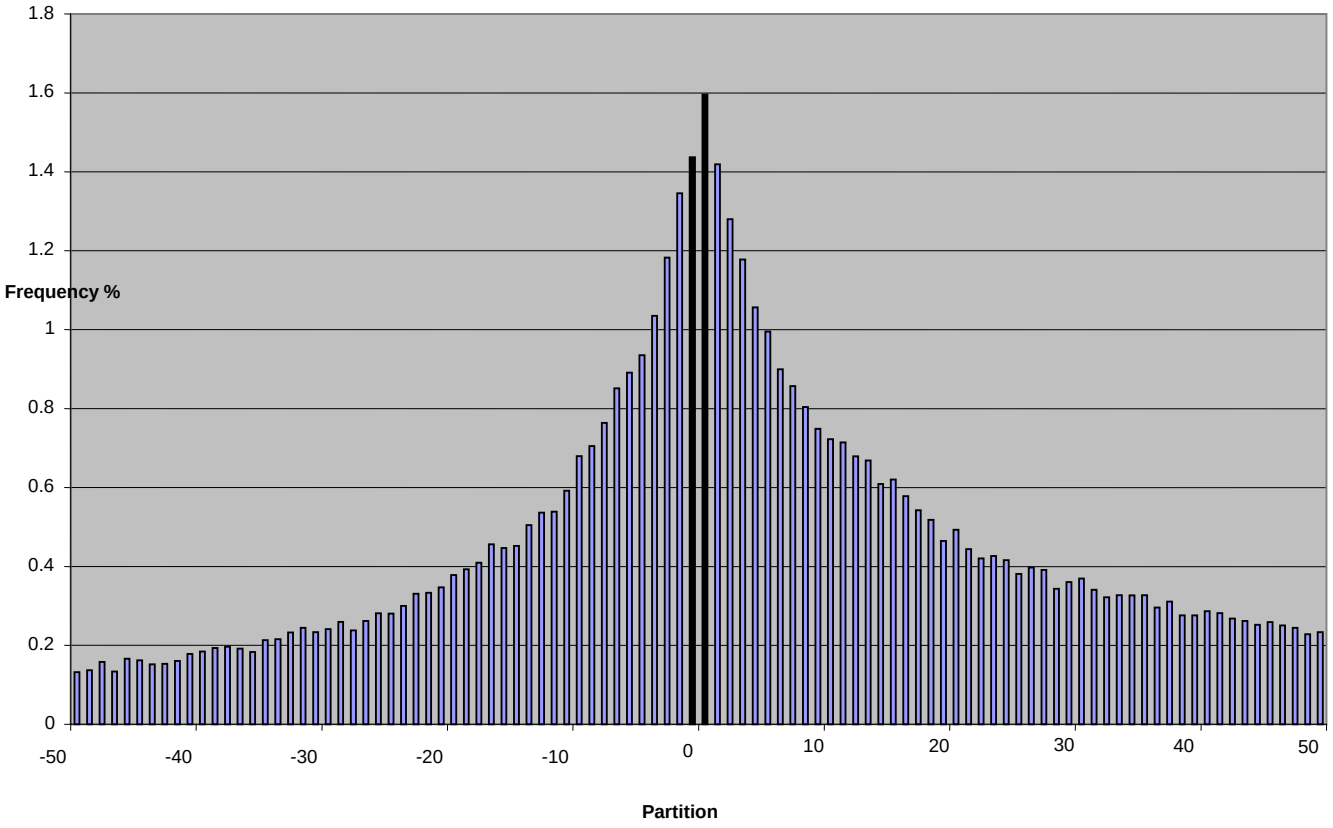

Figure 3C: Unscaled Net Income: Annual Period Ending in Quarter Two

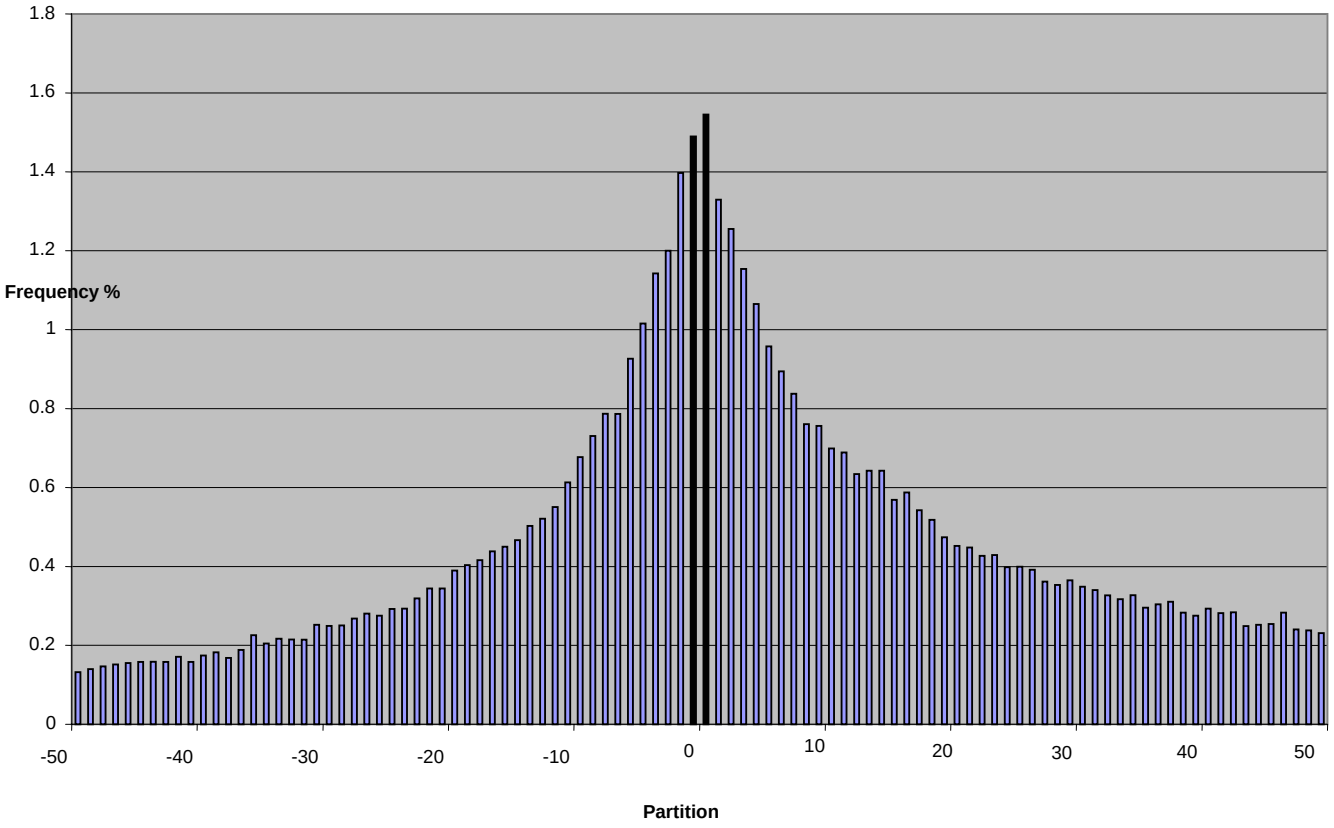

Figure 3D: Unscaled Net Income: Annual Period Ending in Quarter Three

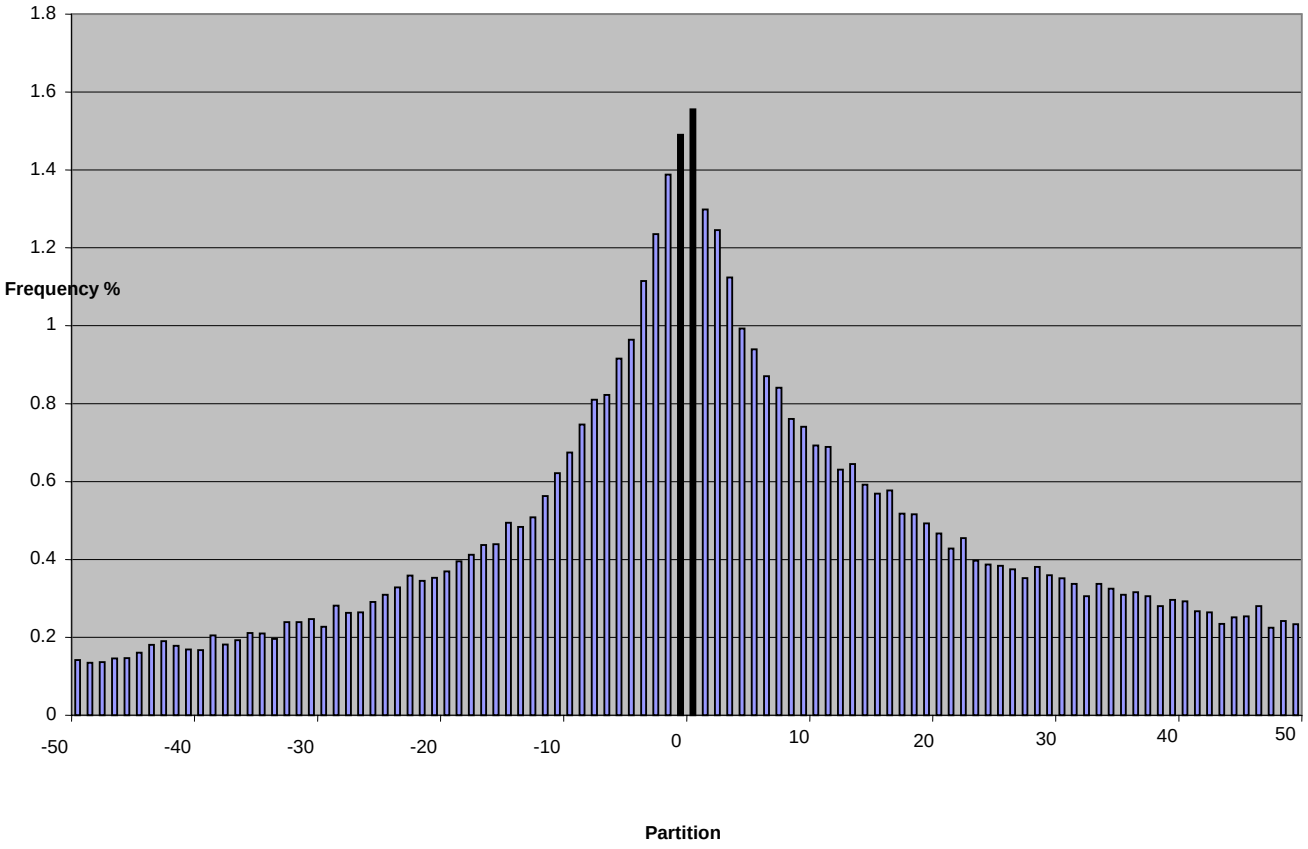

Figure 3E: Unscaled Fiscal Year Net Income: Deviation of Actual from Expected Frequency

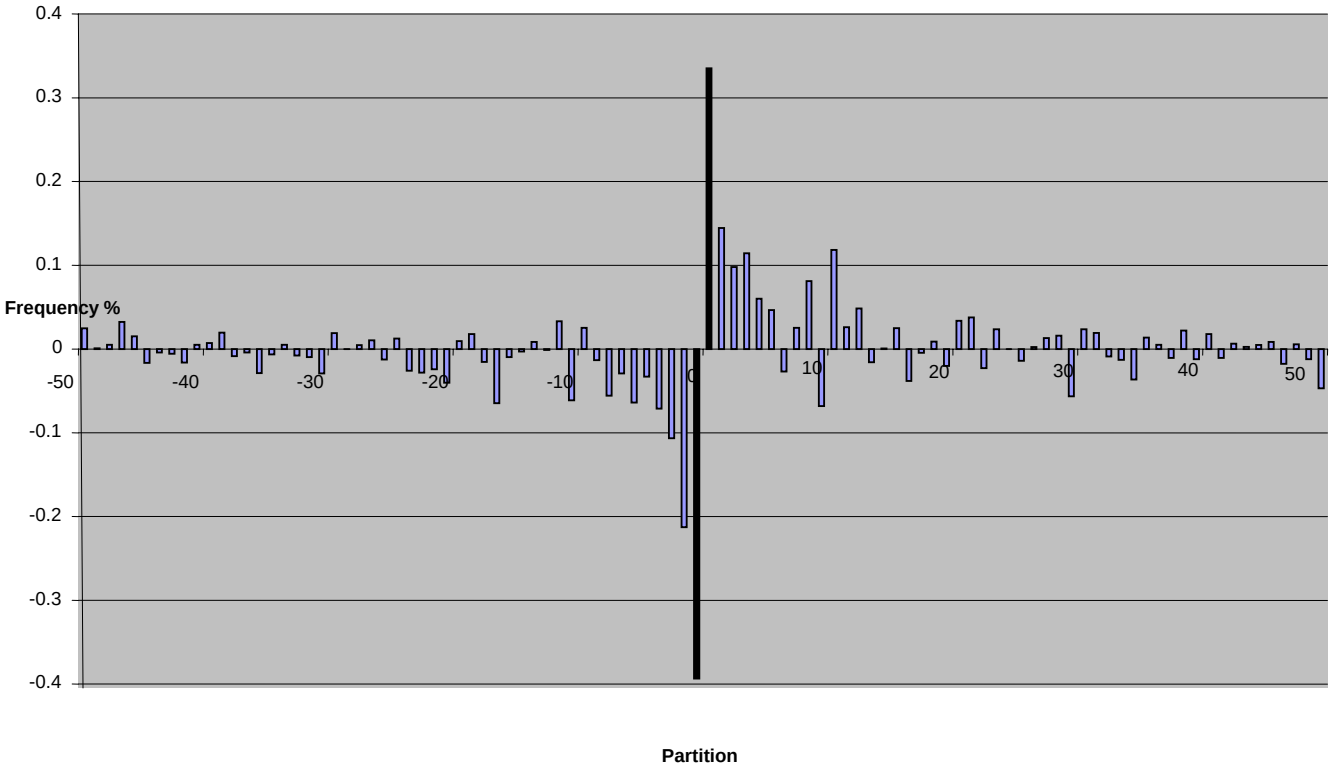

Figure 3:

Figure 3 illustrates the effect of the annual measurement period on net income (unscaled). Partitions 0 and 1 have been darkened to make them easier to identify.

Figure 3A is the histogram of fiscal year net income. Figure 3B is the histogram of net income for the year ending at the close of the first fiscal quarter. Figure 3C is the histogram of net income for the year ending at the close of the second fiscal quarter. Figure 3D is the histogram of net income for the year ending at the close of the third fiscal quarter. Figure 3E represents the differences in each partition between the fiscal year histogram in figure 3A and an equally weighted average of the histograms in figures 3B, 3C, and 3D.

Figure 4: Fiscal Year EPS: Deviation of Actual from Expected Frequency

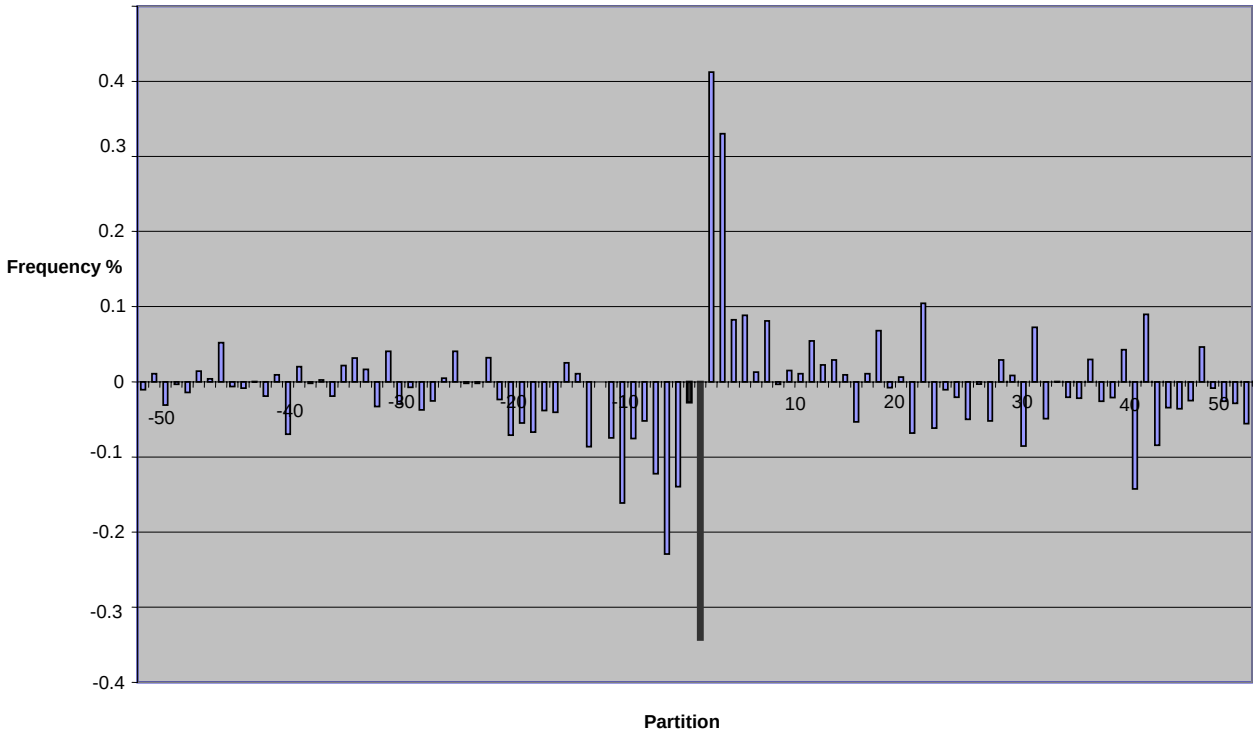

Figure 4 presents the differences in frequency of EPS between the fiscal year and the mean of the other three annual periods. Partitions 0 and 1 have been darkened to make them easier to identify.

Figure 5: Unscaled Fiscal Year Pre-tax Income: Deviation of Actual from Expected Frequency

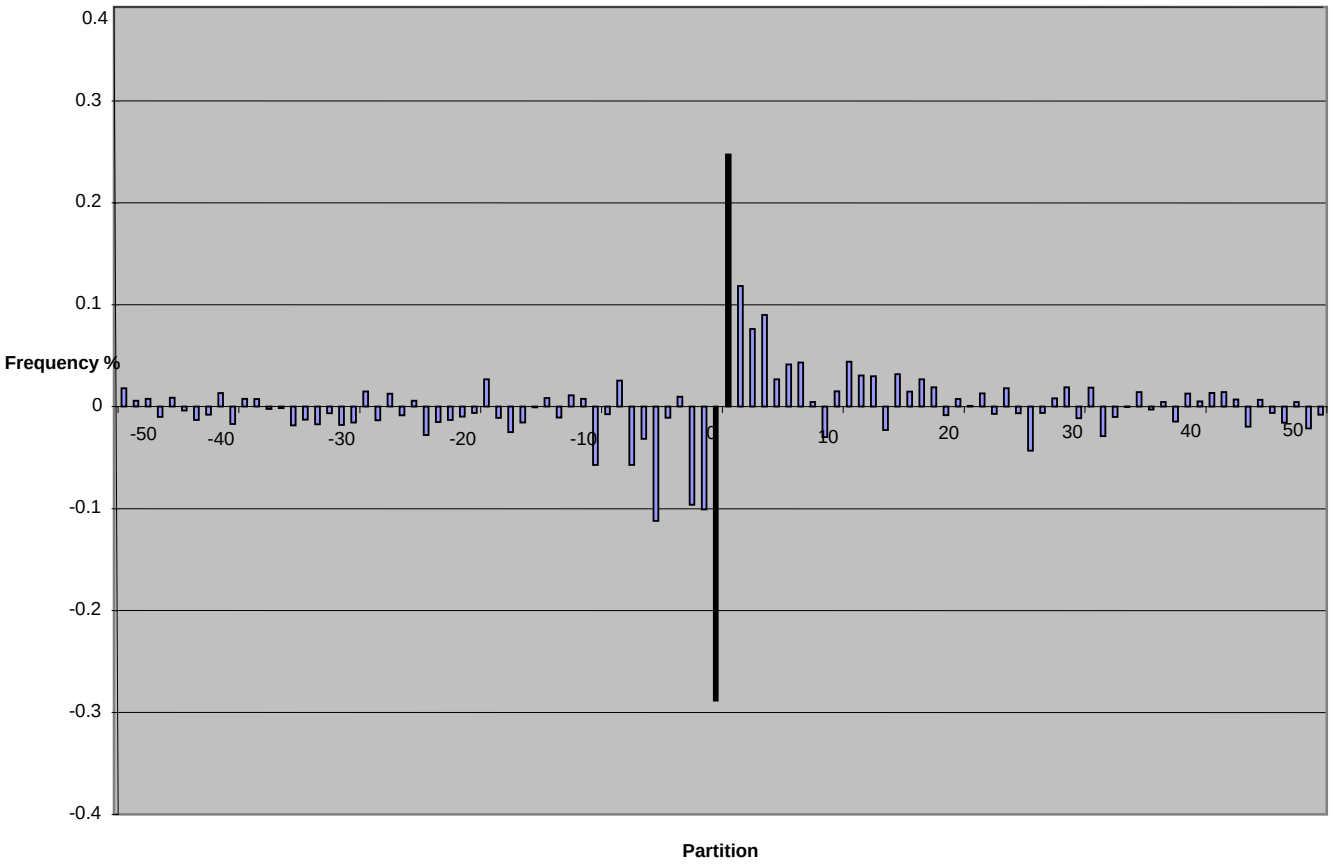

Figure 5 presents the differences in frequency of pre-tax income (unscaled) between the fiscal year and the mean of the other three annual periods. Partitions 0 and 1 have been darkened to make them easier to identify.