JUDIA Journal of Forensic and Investigative Accounting LEARN MORE

Earnings Management to Round Up EPS a Penny: Testing for an Audit Quality Differential between Big Four and Non-Big Four Accounting Firms

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Introduction

Perols et al. (2017) note that misleading or fraudulent financial reporting can lead to the misallocation of resources and result in inefficient capital and labor markets. They further point out that fraudulent financial reporting can be difficult to detect or predict because doing so is like looking for "a needle in a haystack." More specifically, compared to the number of companies that do not manipulate the financial reporting process, the number that does is relatively small. It is this limited availability of known cases of financial fraud that impedes the development of viable fraud detection and prevention models.

Degeorge et al. (1999, pg 1) indicate that "analysts, investors, senior executives and boards of directors consider earnings the single most important item in the financial reports issued by publicly held firms." Mergenthaler et al. (2009) demonstrate that boards often penalize CEOs and CFOs when a company's earnings per share (EPS) falls short of analysts' forecasts or other expectations. These penalties take the form of decreased bonuses or equity awards as well as increased potential for termination, and Mergenthaler et al. (2009) point out that these punitive measures have actually grown since the issuance of Sarbanes-Oxley (SOX). Thus, managers certainly have an incentive to manipulate earnings in their favor. In addition, because of the leeway allowed under accrual basis accounting relative to the timing of recognizing revenues and expenses, key executives have considerable opportunity to manage earnings. Degeorge et al. (1999, pg 2) define earnings management (frequently known as earnings manipulation) as "the strategic exercise of managerial discretion in influencing the earnings figure reported to external audiences."

Nigrini (2018) states that rounding EPS computations to the nearest penny for reporting purposes allows users to concentrate on the important parts of the EPS numbers (i.e., the dollars and cents). However, research (Das and Zhang, 2003; Miller et al., 2012; Jorgensen et al., 2014) shows that managers have regularly manipulated earnings to ensure that the third digit right of the decimal place in computed EPS fell in the range five-nine with much greater frequency than it fell in the spectrum zero-four. Thus, rounding the calculated EPS number to the nearest cent for reporting purposes resulted in EPS being rounded up a penny (rather than down a cent) far more often than should have occurred by chance.

The increase in earnings required to affect the rounding up of EPS by a cent can be quite diminutive. An example by Das and Zhang (2003) clearly demonstrates this point. Black Box reported EPS for the second quarter of 2000 of \$0.72, which precisely equaled the analysts' forecast. In reality, Black Box's calculated EPS was only \$0.71505, which had been rounded up to \$0.72 for financial statement presentation. Black Box's net income that quarter was fourteen million dollars. If net earnings had been only \$750.63 lower, the company would have rounded reported EPS down to \$0.71, thus falling short of the analysts' prediction, creating potential negative consequences for the company and its management.

Numerous recent studies indicate various modes of earnings management decreased noticeably in the U.S. after SOX (e.g., Aono and Guan, 2008; Cohen et al., 2008; Bartov and Cohen, 2009; Lin and Wu, 2014). Jordan et al. (2015) examined earnings management to round EPS up a penny (rather than down a cent) in specific pre- and post-SOX periods and found strong evidence of this manipulative behavior prior to the implementation of SOX but not afterwards. Nonetheless, another body of research in this country indicates Big Four audit firms produce superior quality audits relative to non-Big Four firms and, thus, are able to constrain accruals-based earnings management more effectively than their smaller counterparts

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(e.g., Becker et al., 1998; Francis et al., 1999; Krishnan and Schauer, 2000; Lai, 2009). Using data analytics, the current study tests for the presence of earnings management to round EPS up (rather than down) a penny in post-SOX samples for companies delineated by the size of their audit firms (i.e., Big Four vs. non-Big Four auditors). Results reveal no material evidence of this manipulative behavior for the companies audited by Big Four firms, while the clients of non-Big Four auditors exhibit significant signs of this opportunistic reporting.

The next section provides a review of the literature relative to earnings management enabling the rounding up (instead of down) of EPS by a penny as well as a discussion of the literature examining audit quality differentials between Big Four and non-Big Four firms. This section also cultivates the research question for the project. The following section discusses the methodology and data collection, while the final two sections present the results, conclusions, and limitations of the project.

Literature Review and Development of Research Question

U.S. generally accepted accounting principles (GAAP) necessitate that publicly-held entities present EPS on the face of the income statement. Typically, EPS is calculated as an entity's net earnings divided by the weighted-average number of its common shares outstanding for the period. For example, an entity with \$9,889,200 in net income for the year and 20,000,000 average shares outstanding yields a computed EPS figure of \$0.49446, which would be rounded down and presented in the financial reports at \$0.49. Boosting calculated EPS to \$0.495, thus allowing EPS to be rounded up and reported at \$0.50, would require an increase to net earnings of only \$10,800 (i.e., just one-tenth of one percent of the unmanipulated net income number).

Das and Zhang (2003) indicate that the presence of earnings management allowing EPS to be rounded up (rather than down) a cent can be detected by examining the numbers found in the third digit right of the decimal point in computed EPS (henceforth, known simply as the third digit or 3rdD). Under the assumption of no earnings management, Das and Zhang (2003) note that fifty percent of the companies in a random sample would round calculated EPS up a penny while the other half would round EPS down a cent. That is, with no earnings manipulation, the numbers five-nine should appear as the 3rdD fifty percent of the time, and likewise for the numbers zero-four.

Earnings manipulation to round EPS up (rather than down) a penny would be indicated if the 3rdD falls in the range fivenine (zero-four) at a frequency significantly higher (lower) than fifty percent. Das and Zhang (2003) tested for the presence of such earnings management by calculating the EPS numbers from the quarterly reports for publicly-held companies found in the COMPUSTAT data files for 1989–1998. More specifically, the researchers did not examine the EPS numbers presented in the financial statements (i.e., the rounded EPS numbers) but instead recomputed the unrounded numbers for primary or basic EPS.

Das and Zhang (2003) found that the numbers five–nine (zero–four) appeared as the 3rdD 54.6% (45.4%) of the time. These rates differed significantly from the anticipated frequency of fifty percent and indicated that income was managed so that reported EPS was rounded up a penny much more frequently than it was rounded down a cent. To test whether their expected proportion of fifty percent (assuming no manipulation) was reasonable, Das and Zhang (2003) computed per share amounts for sales, earnings before depreciation, and cash flow from operations. They chose these "per share variables because managers supposedly either have no means or no incentive to round up these variables (Das and Zhang, 2003, pg 36)." For their sample of firm-quarters, the proportion of entities with the 3rdD for sales per share, earnings before depreciation per share in the range five–nine (zero–four) was 49.7% (50.3%), 50.2% (49.8%), and 50.1% (49.9%), respectively. These rates did not deviate significantly from fifty percent and led the researchers to conclude that fifty percent is indeed the proper expected frequency for the 3rdD of unmanipulated EPS.

A number of studies replicated the basics of the Das and Zhang (2003) project, with each one adding unique contributions to the literature in this area. For example, Miller et al. (2012) simulated Das and Zhang (2003) but did so by examining the quarterly reports of public entities from 1995 through 2009. They found that the 3rdD of computed EPS appeared in the range five–nine (zero–four) fifty-three percent (forty-seven percent) of the time, which differed materially from the normal rate of fifty percent, and suggested that companies were rounding EPS up (down) a penny far more (less) often than should have occurred by chance. Moreover, Miller et al. (2012) discovered that the probability of management manipulating earnings to enable EPS to be rounded up (rather than down) a penny increased noticeably as the size of the EPS number decreased.

Jorgensen et al. (2014) performed a study comparable to Das and Zhang (2003) but examined the 3rdD of calculated EPS using annual data for an extensive time frame (i.e., 1980–2010). They added to the literature in this area by segregating their sample into two specific eras based on the accounting standard dictating the calculation and presentation of EPS. Before December 15, 1997, Accounting Principles Board Opinion No. 15 (APBO 15) governed accounting for EPS, while after this date, Statement of Financial Accounting Standard No. 128 (SFAS 128) prescribed the EPS criteria. The researchers investigated primary EPS for the APBO 15 sample and diluted EPS for the SFAS 128 period.

For the APBO 15 sample, the 3rdD of calculated primary EPS appeared in the range five–nine (zero–four) at a rate of 53.29% (46.71%), which differed significantly from the expected proportion of fifty percent and suggested EPS was rounded up (down) a cent far more (less) often than anticipated by chance. For diluted EPS in the SFAS 128 sample, the 3rdD fell in the spectrum five–nine (zero–four) at the rate of 51.11% (48.89%), which again deviated significantly from the expected frequency of fifty percent and indicated that opportunistic rounding of EPS existed even for diluted EPS (i.e., all prior analyses had been for primary or basic EPS).

Jordan et al. (2015) noted that numerous recent studies suggested many forms of earnings management waned or disappeared entirely after the issuance of SOX in 2002 (e.g., Aono and Guan, 2008; Cohen et al., 2008; Bartov and Cohen, 2009; Chen and Huang, 2013; Aubert and Grudnitski, 2014) and questioned whether earnings manipulation to round EPS up (rather than down) a penny might also have decreased in the post-SOX era. Using annual data for distinct pre- and post-SOX eras, Jordan et al. (2015) examined the 3rdD of calculated basic EPS for companies with EPS ranging from \$0.001 to \$1.00. EPS was limited to this spectrum because the likelihood of entities managing earnings to round EPS up a penny (instead of down a cent) is much greater for companies with comparatively low EPS figures, as Miller et al. (2012) demonstrated. During the pre-SOX era, the 3rdD materialized in the range five–nine (zero–four) 51.42% (48.58%) of the time; these rates deviated significantly from fifty percent and, thus, indicated EPS numbers were rounded up (down) a penny far more (less) often than expected by chance. This discrepancy disappeared in the post-SOX sample as the 3rdD fell in the spectrum five–nine (zero–four) at a frequency of 49.88% (50.12%), which did not differ significantly from fifty percent. This finding implies that, overall, earnings management to round EPS up (rather than down) a cent does not exist in the post-SOX era.

In a later study, Jordan et al. (2018) point out that compelling research suggests smaller companies are more prone to earnings management than larger entities (e.g., Aharony et al., 1993; Glaum et al., 2004; Gu et al., 2005; Sevin and Schroeder, 2005; Johnson, 2009; Jordan et al., 2017) and posit that earnings management to round EPS up (instead of down) a penny might still be practiced among smaller entities. Testing a post-SOX period (2003–2016) of annual data for companies reporting basic EPS between \$0.001 and \$1.00, Jordan et al. (2018) found no evidence of this opportunistic reporting for the largest two-thirds of the company-years. That is, the rates at which the 3rdD appeared in the ranges five–nine and zero–four did not differ significantly from fifty percent. For the smallest third of the company-years; however, the 3rdD occurred in the spectrum five–nine (zero–four) 51.63% (48.37%) of the time, which deviated significantly from the conventional rate of fifty percent and indicates that even after the implementation of SOX, smaller entities continue to manipulate earnings to enable EPS to be rounded up a cent rather than down a penny.

The Jordan et al. (2018) study above suggests that earnings management to round EPS up (instead of down) a cent was not completely eliminated by SOX. If this type of opportunistic reporting is related to entity size (as Jordan et al., 2018, surmise), perhaps it is associated with other factors as well. For example, the following studies indicate that in the U.S. Big Four audit firms produce superior quality audits relative to their non-Big Four counterparts in various contexts:

- Colbert and Murray (1999)—found a strong positive relationship between peer review ratings of audit firms and audit firm size.
- Krishnan and Schauer (2000)—determined that the likelihood of NFP voluntary health and welfare organizations complying with GAAP disclosure requirements was positively linked to audit firm size, with the clients of Big Six auditors conforming the most closely to GAAP requirements.
- Geiger and Rama (2006)—discovered that Big Four firms had significantly lower error rates than non-Big Four firms relative to reporting their clients' going concern problems.
- Forbes (2014)—showed that the quality of employee benefit plan audits was directly related to audit firm size "with more small firms than large firms coming up short" (pg 15).

• McGowan et al. (2014)—found that Big Four firms were more likely than non-Big Four auditors to report internal control deficiencies for NFP hospitals.

Several studies examined the ability of audit firms to constrict their clients' use of discretionary accruals and found that Big N (i.e., 8/7/6/5/4) firms did a better job of this than non-Big N firms and, thus, more effectively impeded their auditees' attempts at earnings management (e.g., Davidson and Neu, 1993; Becker et al., 1998; Francis et al., 1999; Krishnan, 2003; Lai, 2009). A smaller group of studies found that a quality differential seems to exist between Big Four and non-Big Four audit firms relative to earnings management involving the rounding up of EPS. In particular, Jordan et al. (2010) performed digital analysis on the two numbers immediately right of the decimal point in reported basic EPS figures for a post-SOX sample. In the second digit right of the decimal place (i.e., the cents position), they found no data anomalies for clients of either Big Four or non-Big Four auditors suggesting the opportunistic rounding of EPS. However, a different result occurred in the first digital position right of the decimal point (i.e., called the FDP). For the entities audited by non-Big Four firms, eights and nines occurred in the FDP significantly less frequently than anticipated while zeros, ones, and twos appeared in this position at abnormally high rates. All other numbers (i.e., three-seven) occurred in the FDP at their expected rates. Jordan et al. (2010, pg 25) surmised that "when the FDP is high (i.e., an eight or nine), management apparently manipulates earnings to round EPS up until the FDP reaches or crosses zero, thereby increasing the first digit left of the decimal point by one." The companies audited by Big Four firms did not exhibit this opportunistic rounding of EPS as every number (zero-nine) arising in the FDP of EPS conformed to its expected frequency (i.e., approximately ten percent). This result provided anecdotal evidence suggesting that Big Four firms restrained their clients' attempts to manipulate earnings to round up EPS more effectively than non-Big Four firms.

Another study examining audit quality (i.e., audit firm size) and the rounding up of EPS is the Miller et al. (2012) project referenced earlier. The researchers investigated the 3rdD in calculated EPS for a sample period encompassing both pre- and post-SOX years (i.e., 1995–2009). As mentioned previously, Miller et al. (2012) discovered that the 3rdD fell in the range five–nine (zero–four) abnormally more (less) often than anticipated, thus indicating that managers manipulated earnings to enable the reported EPS number to be rounded up a penny with far greater frequency than it would be rounded down a cent. In addition to showing that the likelihood of this earnings management increased as the size of the EPS number decreased, Miller et al. (2012) also observed that the most habitual manipulators were disproportionately audited by non-Big Four firms.

The results from the above studies lead to the research question for the present project. Specifically, Miller et al. (2012) found that Big Four audit firms appeared to constrain earnings management to round EPS up (rather than down) a cent more aggressively than non-Big Four firms based on a sample containing numerous years from both pre- and post-SOX eras. Yet, Jordan et al. (2015) discovered that this form of earnings management is practiced much less pervasively in the post-SOX age relative to the pre-SOX period. Because Miller et al.'s (2012) results were heavily influenced by both pre- and post-SOX data, it is unknown whether an audit quality differential exists between Big Four and non-Big Four firms relative to restricting earnings management to round EPS up (instead of down) a penny in the post-SOX era. The current study attempts to answer this question and, thus, fills a vacuum in the literature concerning both audit quality and earnings management.

Data and Methodology

To determine if a differential exists between the clients of Big Four and non-Big Four audit firms relative to the propensity to manage earnings to round EPS up (rather than down) a cent in the post-SOX era, annual data are collected on U.S. publicly-held entities with positive income from the COMPUSTAT files for the period 2003–2016. As prior research (Miller et al., 2012) shows, the likelihood of EPS being rounded up a penny instead of down a cent increases markedly the lower the EPS figure. Accordingly, and to remain consistent with other studies in this area (i.e., Jordan et al., 2015; Jordan et al., 2018), the sample includes only company-years with basic EPS in the range \$0.001 to \$1.00. The basic EPS number for each company-year is recomputed using the entity's appropriate earnings figure and weighted-average number of common shares made available in the COMPUSTAT files.

The 3rdD of this calculated EPS figure represents the focal point of the study. As Das and Zhang (2003) posit, the 3rdD should appear in the spectrums five-nine and zero-four in approximately equal proportions (i.e., fifty percent in each range). Earnings management intended to enable EPS to be rounded up a penny (rather than down a cent) would be indicated if the 3rdD occurs in the range five-nine (zero-four) at a frequency significantly higher (lower) than fifty percent. Proportions

tests are used to evaluate the statistical significance of the discrepancies between the actual rates observed and the expected frequency of fifty percent.

Only company-years revealing the identity of their audit firms in COMPUSTAT are included in the sample. The test for earnings management to round EPS up (rather than down) a penny is conducted first on the total sample of entities, including auditees of both Big Four and non-Big Four audit firms. To test for an audit quality differential relative to restricting this type of earnings management, the total sample is then divided into two sub-samples depending on the entities' auditors (i.e., one group contains clients of Big Four firms while the second one comprises auditees of non-Big Four auditors). The tests for earnings management to round EPS up (instead of down) a penny is then conducted for each of these two sub-samples.

As Jordan et al. (2010) note, in evaluating audit quality based on audit firm size, some debate exists on how to classify midsized audit firms like BDO Seidman, Grant Thornton, Crowe Horwath, etc. Yet, when examining audit quality relative to reporting going concern issues, Geiger and Rama (2006) detected a significant difference between Big Four and non-Big Four firms but found no material difference between mid-sized firms and local/regional ones. Thus, the present project follows suit with prior studies (e.g., Becker et al., 1998; Francis et al., 1999; Lai, 2009) evaluating the association between audit quality (i.e., audit firm size) and constraining earnings management and divides the audit firms into two groups (i.e., Big Four audit firms and non-Big Four audit firms, including both mid-sized firms and local/regional ones).

Results

For the post-SOX years 2003–2016, COMPUSTAT files contained 25,940 company-years that reported basic EPS between \$0.001 and \$1.00 and also provided the names of their audit firms. Table 1 shows that for these entities, the 3rdD of calculated basic EPS fell in the range five–nine (zero–four) 50.43% (49.57%) of the time. The proportions test indicates that these frequencies do not deviate significantly from the anticipated rate of fifty percent (i.e., p-level of 0.170). This implies that for the overall sample, which includes clients of both Big Four and non-Big Four auditors, the presentation of EPS in dollars and cents results from calculated EPS being rounded up a penny at approximately the same rate it is rounded down a cent. That is, it appears managers do not manipulate earnings to allow EPS to be rounded up a cent rather than down a penny. This finding is not surprising given the results by Jordan et al. (2015) that this mode of earnings management existed in the pre-SOX era but vanished after SOX (i.e., the evidence here corroborates Jordan et al.'s, 2015, post-SOX results).

Table 1: 3rdD Frequencies for Calculated EPS (Full Sample)

Total Sample (N=25,940):

	<u>3rdD Rar</u>	<u>ige</u>
	<u>five-nine</u>	zero-four
Actual count (n)	13,081	12,859
Actual frequency	50.43%	49.57%
Expected frequency	50.00%	50.00%
Z statistic	1.372	-1.372
p-level	0.170	0.170

The real research question addressed in this study, though, is whether an audit quality differential exists between Big Four and non-Big Four firms concerning their ability to constrain earnings management to round EPS up a penny instead of down a cent in the post-SOX age. To answer this question, the full sample of company-years is split into two sub-samples delineated based on whether the firm conducting the audit was a Big Four or non-Big Four firm. Of the total 25,940 company-years in the full sample, 15,496 were audited by Big Four firms while 10,444 were examined by non-Big Four firms. Panel A of Table 2 shows the results for the entities with Big Four auditors. For this group, notice that 49.86% (50.14%) of the 3rdDs in computed EPS appeared in the spectrum five–nine (zero–four). These frequencies do not deviate materially from the normal proportion of fifty percent (i.e., p-level of 0.730) and indicate that clients of Big Four auditors do not manage earnings to round EPS up a penny rather than down a cent.

Table 2: 3rdD Frequencies for Calculated EPS (Big Four vs. Non-Big Four)

Panel A—Big Four Clients (N=15,496):

-		3 rd D Range
	five-nine	zero-four
Actual count (n)	7,726	7,770
Actual frequency	49.86%	50.14%
Expected frequency	50.00%	50.00%
Z statistic	-0.345	0.345
p-level	0.730	0.730

Panel B—Non-Big Four Clients (N=10,444):

	· · · · · · · · · · · · · · · · · · ·	3 rd D Range
	five-nine	zero-four
Actual count (n)	5,355	5,089
Actual frequency	51.27%	48.73%
Expected frequency	50.00%	50.00%
Z statistic	2.593	-2.593
p-level	0.0095*	0.0095*

*Difference between actual and expected frequency is significant at 0.01 level.

Panel B of Table 2, however, presents distinctly different findings for the entities whose financial statements were audited by non-Big Four firms. For these company-years, 51.27% (48.73%) of the 3rdDs in computed EPS fell in the range five-nine (zero-four), and these rates deviate significantly from the anticipated proportion of fifty percent (i.e., p-level of 0.0095). This finding suggests that when presenting EPS in the financial reports, these entities rounded EPS up (down) a penny at a much higher (lower) frequency than expected by chance.

The apparent absence (presence) of earnings management to round EPS up a penny instead of down a cent in the post-SOX era for the clients of Big Four (non-Big Four) auditors signifies an audit quality differential between these two groups of audit firms with respect to their ability to inhibit this form of earnings management. Still, some factor other than audit quality could be driving the results shown in Table 2. For example, substantial research suggests that smaller companies engage in various forms of earnings management more aggressively than larger entities (e.g., Aharony et al., 1993; Glaum et al., 2004; Gu et al., 2005; Sevin and Schroeder, 2005; Johnson, 2009; Jordan et al., 2017). Indeed, as noted earlier, Jordan et al. (2018) tested for earnings management to round EPS up a penny instead of down a cent in post-SOX samples segregated by entity size and found that while the largest two-thirds of the entities did not engage in this form of earnings management, the smallest third of the companies practiced it at significant levels.

If the clients of non-Big Four firms in the current study are noticeably smaller than the auditees of Big Four firms, there exists a possibility that the findings here could be at least partially a function of entity size rather than audit quality. In fact, the median total asset size of \$611 million for the company-years audited by Big Four auditors dwarfs the median total asset size of approximately ninety-one million dollars for the non-Big Four auditees.

To attempt to determine if the findings in the current project are the result of audit quality differentials rather than company size, the effects of entity size are mitigated, at least to a certain degree. As just discussed, Jordan et al. (2018) showed in their post-SOX examination of the relationship between entity size and the propensity for entities to round EPS up (instead of down) a cent that only the smallest third of the companies in their sample engaged in this opportunistic reporting behavior. Accordingly, to make the sample in the current study more homogeneous relative to company size and, thus, remove a significant amount of the size-based noise in the results, the tests are repeated just for the smallest third of the entities in the sample.

Table 3 contains the results for the smallest 8,647 company-years in the sample and includes auditees of both Big Four and non-Big Four CPA firms. The 3rdD of computed EPS falls in the range five–nine (zero–four) at the rate of 51.54% (48.46%). These frequencies deviate materially from the normal proportion of fifty percent (i.e., p-level of 0.004) and, similar to the

results found by Jordan et al. (2018), suggest that managers of the smallest third of the entities manipulate earnings to enable reported EPS to be rounded up (down) a penny much more (less) often than anticipated by chance.

Table 3: 3rdD Frequencies for Calculated EPS (Smallest Third of Entities)

Smallest Third Sub-Sample (N=8,647):

	· · · · · · · · · · · · · · · · · · ·	3 rd D Range
	five-nine	zero-four
Actual count (n)	4,457	4,190
Actual frequency	51.54%	48.46%
Expected frequency	50.00%	50.00%
Z statistic	2.861	-2.861
p-level	0.004*	0.004*

*Difference between actual and expected frequency is significant at 0.01 level.

For this sub-sample of company-years that are relatively comparable in size, the key question now is whether an audit quality differential exists with respect to the entities' predilection to manipulate earnings to round EPS up (instead of down) a cent. To address this issue, the sub-sample for the smallest third of the company-years is segregated based on their audit firms (i.e., Big Four vs. non-Big Four). Panel A of Table 4 furnishes the findings for the 2,731 auditees of Big Four firms in this group. Interestingly, no persuasive evidence of this form of earnings management appears in Panel A. In particular, the 3rdD of computed EPS occurs in the range five–nine (zero–four) 50.75% (49.25%) of the time, and these percentages do not deviate materially from the conventional rate of fifty percent (i.e., p-level of 0.444). Thus, even within this sub-sample of comparatively small entities, the clients of Big Four firms do not appear to manage earnings to round EPS up (rather than down) a penny.

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Table 4: 3rdD Frequencies for Calculated EPS (Big Four vs. Non-Big Four in Smallest Third)

Panel A—Big Four Clients (N=2,731):

	3'	^{ad} D Range
	five-nine	zero-four
Actual count (n)	1,386	1,345
Actual frequency	50.75%	49.25%
Expected frequency	50.00%	50.00%
Z statistic	0.765	-0.765
p-level	0.444	0.444
Panel B—Non-Big Four Clients (N=5,916):		
	3 ¹	rd D Range
	five-nine	<u>zero-four</u>
Actual count (n)	3,071	2,845
Actual frequency	51.91%	48.09%
Expected frequency	50.00%	50.00%
Z statistic	2.925	-2.925
p-level	0.003*	0.003*

*Difference between actual and expected frequency is significant at 0.01 level.

For the same sub-sample comprising the smallest third of the entities, Panel B of Table 4 shows the findings for the 5,916 company-years with non-Big Four audit firms. In stark contrast to the findings in Panel A for the Big Four auditees, Panel B suggests that the clients of non-Big Four firms do engage in earnings management to round EPS up a cent rather than down a penny. More specifically, for this sub-group, the 3rdD of computed EPS appears in the spectrum five–nine (zero–four) 51.91% (48.09%) of the time, which differ significantly from the anticipated proportion of fifty percent (i.e., p-level of 0.003). This suggests, of course, that when rounding calculated EPS to the nearest cent for financial reporting purposes, the auditees of non-Big Four firms round EPS up (down) a penny much more (less) frequently than would be expected with unmanipulated income.

In addition to examining the frequencies at which numbers in the ranges five-nine and zero-four appear as the 3rdD of calculated EPS, Das and Zhang (2003) also investigated the rates occurring for each individual number (zero–nine). As Das and Zhang (2003) note, absent manipulation, each number (zero–nine) should appear as the 3rdD of computed EPS about ten percent of the time. Yet, for their sample encompassing the period 1989–1998, they discovered a significant discontinuity at the number four. In particular, fours occurred as the 3rdD far less often than expected. Das and Zhang (2003) posited that this meant the more contiguous the unmanipulated 3rdD was to the cutoff (i.e., five) for rounding EPS up a penny, the more likely earnings would be manipulated to ensure the upward rounding of EPS took place.

In their examination of earnings management to round EPS up (instead of down) a penny in pre- and post-SOX periods, Jordan et al. (2015) emulated this procedure and found similar results in their pre-SOX sample (i.e., a pronounced break at the number four with significantly fewer fours than expected). In the post-SOX sample, however, each number (zero–nine) materialized as the 3rdD of calculated EPS at its anticipated rate (i.e., approximately ten percent of the time). This result provided further support for their conclusion that earnings management to round EPS up (rather than down) a cent that existed prior to SOX disappeared in general after SOX.

The present study simulates the above test for the sub-sample containing the smallest third of the entities. For this group, Panel A of Table 5 provides the results for the company-years audited by Big Four accounting firms. Notice that the number four appears as the 3rdD of calculated EPS 9.59% of the time, which approximates the expected rate of ten percent (i.e., plevel of 0.499 indicates the difference is not statistically significant). Indeed, using traditional measures of statistical significance (i.e., 0.01 and 0.05), Panel A reveals that all numbers occur as the 3rdD of computed EPS at about their expected rates for the Big Four auditees. This suggests Big Four auditees do not manipulate income to round EPS up a penny rather than down a cent.

Table 5: 3rdD Frequencies for Calculated EPS (Big Four vs. Non-Big Four in Smallest Third): Zero-Nine

e		, ,			$3^{rd}D$					
	0	1	2	3	4	5	6	7	8	9
Actual count (n)	260	276	271	276	262	280	268	302	285	251
Actual freq. (%)	9.52	10.11	9.92	10.11	9.59	10.25	9.81	11.06	10.44	9.19
Expected freq. (%)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Z statistic	-0.804	0.153	-0.102	0.153	-0.676	0.408	-0.293	1.812	0.727	-1.378
p-level	0.422	0.878	0.919	0.878	0.499	0.683	0.769	0.070	0.467	0.168

Panel A—Big Four Clients (N=2,731):

Panel B—Non-Big Four Clients (N=5,916):

	3 rd D									
	0	1	2	3	4	5	6	7	8	9
Actual count (n)	586	607	570	539	543	622	624	620	601	604
Actual freq. (%)	9.91	10.26	9.63	9.11	9.18	10.51	10.55	10.48	10.16	10.21
Expected freq. (%)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Z statistic	-0.221	0.646	-0.914	-2.258	-2.085	1.296	1.383	1.209	0.386	0.516
p-level	0.825	0.518	0.360	0.024*	0.037*	0.195	0.167	0.227	0.700	0.606

*Difference between actual and expected frequency is significant at 0.05 level.

Panel B in Table 5 depicts a vastly different outcome for the non-Big Four auditees. Specifically, materializing as the 3rdD of computed EPS 9.11% and 9.18% of the time, threes and fours (respectively) fall significantly below the expected rate of ten percent (i.e., p-levels of 0.024 and 0.037). Unlike the pre-SOX sample for Jordan et al. (2015) where only four were significantly underrepresented as the 3rdD of calculated EPS, the companies audited by non-Big Four firms in the smallest third sub-sample in the current study appear even more aggressive in their manipulation of income to round EPS up, rather than down, a penny (i.e., with the rates for both digits immediately below the cutoff for upward rounding significantly below their expected frequency). Taken together, the results in Tables 4 and 5 present compelling evidence that the clients of non-Big Four accounting firms manipulate earnings to round EPS up (rather than down) a cent while no material signs of this questionable behavior emerge for the Big Four auditees.

Since the company-years in the sub-sample examined in Tables 4 and 5 are fairly homogeneous in size, this suggests an audit quality differential between Big Four and non-Big Four audit firms (rather than a size differential among the auditees) drives the results in this study. Nevertheless, another factor that could be causing the findings is the operating performance of the entities. In particular, Yoon and Miller (2002) suggest that an inverse relationship occurs between profitability and the propensity to manage earnings, with entities experiencing poor operating performance engaging in earnings management more aggressively than companies with robust earnings levels. Thus, if the companies audited by non-Big Four firms are less profitable overall as compared to the auditees of Big Four firms, the explanation for the results in this study could be that Big Four firms are not necessarily constraining this form of earnings management with more tenacity than non-Big Four auditors but that the auditees of non-Big Four firms simply have more desire or need to manage earnings than the clients of Big Four auditors. Using return on assets (ROA) as the measure of profitability, this does not appear to be the case. In particular, for the sub-sample containing the smallest third of the company-years, the median ROAs for the clients of Big Four firms are almost identical (i.e., 6.70% and 6.89%, respectively).

A final factor that could be driving the findings in this study (other than an audit quality differential) is the level of debt leverage for the companies in the samples. In particular, some research suggests that companies with high levels of debt are more apt to manage earnings upward than entities with low or moderate debt levels (e.g., see Aharony et al., 1993; Sweeney, 1994; Visvanathan, 1998). If the companies audited by non-Big Four firms carry debt leverages well above those of the Big Four auditees, perhaps the earnings management of the former group noted in this study results not from an audit quality differential but rather from management's desire to offset the negative perceptions caused by their high debt levels. To address this question, for the sub-sample of the smallest third of the entities, the median debt-to-assets ratio is computed for the group of companies audited by Big Four firms and the group of non-Big Four auditees. The median debt ratios for these two groups are relatively similar at 0.34 and 0.37, respectively, therefore it is unlikely that this comparatively small difference in debt leverage explains the results found in this study. Thus, while there is no way to prove definitively that the findings here derive from an audit quality differential between Big Four and non-Big Four auditors relative to their ability to constrain earnings management, this certainly seems to be the most plausible explanation.

There are several possible explanations for the difference in audit quality between Big Four and non-Big Four auditors. Many of these relate to the brand names the Big Four firms have developed. These brand names allow the Big Four firms to charge higher audit fees but also create higher risk for losses from audit failures. Arthur Andersen's demise well illustrates the ultimate loss a firm could suffer. To mitigate this risk, Big Four firms invest significantly in training their auditors and developing new technologies to reduce the chance of audit failure and thereby increase their audit quality.

The brand names the Big Four have developed also allow them to acquire a tremendous market share of audits of public companies. This market share then allows these firms to exercise controls over the clients they choose to audit, either initial or continuing clients. These strong client selection and retention requirements allow the Big Four firms to avoid risky clients. These requirements also allow the Big Four firms more freedom in challenging client's accounting procedures even for items where materiality is marginal. Non-Big Four firms, some of which are working to develop brand names to compete with the Big Four, might not feel this freedom given their smaller client base of public firms.

Summary, Conclusion, and Limitations

As noted previously (see Perols et al., 2017), detecting financial statement manipulation is somewhat difficult because relative to the amount of unmanipulated data, comparatively few known cases of financial fraud exist, which makes the development of fraud detection models fairly challenging. Nonetheless, using digital analytics to determine the presence or absence of specific patterns in large data sets can sometimes lead to the unmasking of financial manipulation. Such is the case with ascertaining the occurrence of earnings management to round reported EPS up a penny rather than down a cent.

More specifically, prior research (Das and Zhang, 2003; Miller et al., 2012; Jorgensen et al., 2014) demonstrated that within large samples of entities, the third digit right of the decimal place in calculated EPS fell in the range five–nine (zero–four) disproportionately more (less) often than should have occurred by chance. This implied that income was manipulated upward so that when EPS figures were rounded to the nearest cent for financial reporting purposes, they were rounded up a penny much more frequently than they were rounded down a cent.

Using a post-SOX sample of U.S. public entities, the current study tests for an audit quality differential between Big Four and non-Big Four firms concerning their ability to inhibit this form of earnings management. Results suggest that such a

quality differential exists as the clients of non-Big Four firms round EPS up (down) a penny at a rate significantly higher (lower) than anticipated by random occurrence. Alternatively, auditees of Big Four firms round EPS up a penny at approximately the same frequency they round EPS down a cent, which is the expectation given no earnings manipulation.

The present project tests for earnings management to round EPS up a cent, rather than down a penny, on a macro scale as the sample comprises a large number of entities. Thus, from the current study, no statement can be made about the propensity of individual companies to engage in this form of earnings manipulation. Yet, as Miller et al. (2012) indicate, the testing procedure used here can be modified to evaluate an individual entity by examining its EPS rounding pattern over time. For example, over a fifteen-year period a public company will have issued sixty quarterly reports, with the computed EPS figure rounded to the nearest cent each quarter. Absent manipulation, EPS should be rounded up a cent about thirty times and down a penny about thirty times as well. Evidence of earnings management would appear if the reported EPS figure was rounded up a penny significantly more frequently than fifty percent of the time. The statistical significance of the difference between the actual rate of rounding up and the conventional rate of fifty percent could be evaluated using a proportions test.

Thus, the present study could be expanded in future research to examine audit quality differentials between Big Four and non-Big Four firms by applying the above procedure to individual companies. If Big Four firms stifle this form of earnings management more aggressively than non-Big Four firms, one would contemplate seeing a smaller portion of the Big Four auditees with abnormally high frequencies of EPS being rounded up a cent (i.e., relative to the clients of non-Big Four firms). In addition to providing a research tool for academic accountants, Miller et al. (2012) suggest that the entity-specific application of the procedure can also be employed by financial statement users to determine which managers or companies have rounded up EPS a cent at rates exceeding normal expectations, thus allowing users to gauge the integrity of said managers. The procedure could also be used by auditors in assessing the likelihood of whether an individual company is engaged in this form of earnings management.

As with many projects, time and resource restraints result in possible limitations associated with the current study's results. For example, as discussed earlier, Mergenthaler et al. (2009) note that boards of directors often penalize CEOs when their companies fail to meet analysts' earnings expectations. This penalty is because the market places higher values on entities that consistently meet earnings expectations than on those that do not (Kasznik and Mcnichols, 2002). Thus, managers of companies with unmanipulated EPS falling short of analysts' forecasts by only a penny would have great incentive to manipulate income to enable calculated EPS to be rounded up rather than down. The findings in the present study might have been different if it had examined only entities that exactly met their earnings expectations. Similarly, as Miller et al. (2012) indicate, the motivation to round EPS up (rather than down) a cent increases dramatically the lower the EPS value. For this reason, the current project examines companies with EPS between \$0.001 and \$1.00. Would the results have been the same (i.e., an apparent audit quality differential between Big Four and non-Big Four firms) if the sample had been pared down to company-years with much lower EPS figures (e.g., between \$0.001 and \$0.020)?

Finally, the current study does not segregate the sample companies by industry and perform industry analyses. Yet, some research suggests the motivation to engage in earnings management activity differs across industries (Wasiuzzaman et al., 2015) and that a positive relationship exists between industry competitiveness and the level of earnings manipulation occurring within an industry (Datta et al., 2013). Would an audit quality differential materialize between Big Four and non-Big Four firms relative to their ability to constrain earnings management to round EPS up a cent, rather than down a penny, within a highly competitive industry? The above limitations of the current project present legitimate research questions for future studies.

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Appendix—Glossary of Terms

Big Four accounting firms—The largest international accounting firms. They are Deloitte, EY, KPMG, and PwC.

Non-Big Four accounting firms—For purposes of this study, all other accounting firms engaged in audits of public companies.

Basic EPS—The amount of net income available to common stockholders divided by the weighted-average number of common stock shares outstanding during the period.

Primary EPS—Essentially the same as basic EPS. This term was used while APBO 15 was GAAP for EPS.

Diluted EPS—A more conservative calculation of EPS. It considers the potential negative impact on EPS of the potential exercise of certain securities (for example, convertible bonds and stock options) the company may have outstanding at the end of the period.

Earnings estimate—Predictions by financial analysts.

Sarbanes-Oxley—A law passed in 2002 as a result of the financial and accounting scandals at the turn of the century. It imposes new requirements on public companies and created the Public Company Accounting Oversight Board (PCAOB) to regulate audits of public companies.

COMPUSTAT—A database of financial statement information for public companies.

Discretionary accruals—Accounting choices made by companies where judgements are allowed within GAAP. Simple examples would be the percentage used to measure bad debt expense or the number of years used to depreciate a fixed asset. Adjustments to these estimates can be used as a means of manipulating earnings.