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Rounding Reported Earnings Numbers and Firm Characteristics in Korea

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ABSTRACT

In this study, we examine whether Korean firms manage earnings through rounding the second digit of earnings numbers to achieve the reference point. We also investigate whether there is a relationship between the abnormal rounding behavior of earnings numbers and the reporting entities' firm characteristics such as financial leverage, operating performance, size, and audit quality. The results in this study suggest the following; first, Korean firms round the second digit of earnings numbers to achieve the key reference point. Second, among positive earnings firms, highly leveraged firms engage in earnings management through rounding earnings numbers more aggressively than low leveraged firms. However, financial leverage may not affect managers' earnings management through rounding the second digit when they report losses. Third, operating performance may not affect the mangers' efforts to round the second digit in order to achieve the reference point among both positive earnings firms and negative earnings firms. Fourth, among positive earnings firms, small firms are more likely to engage in earnings management than large firms are. While among negative earnings firms, large firms do more actively engage in earnings management than small firms do. Fifth, on the contrary to our expectation, when losses are reported, firms using Big 4 auditors do more aggressively engage in earnings management than firms using Non-Big 4 auditors. The results for the third digit are slightly different than those for the second digit of earnings numbers.

Key Words: Rounding behavior, Earnings, Reference point

JEL Classifications: A1

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1. INTRODUCTION

In this study, we investigate Korean managers' earnings management through rounding earnings numbers to achieve key cognitive reference points which are perceived to be important points by the user and the preparer of accounting information. We also examine if there are any relationships between managers' rounding behaviors and characteristics of reporting firms.

Thomas (1989) addressed two general reasons why managers tend to round earnings numbers. One reason relates to earnings as key cognitive reference points to accounting information users for their firm valuations. This view is called the firm valuation perspective. From the firm valuation perspective, small changes in reported earnings near key reference points have a disproportionally larger effect on perceived firm value due to cognitive limitations of decision makers. For example, earnings of $399,000 may be perceived as three hundred thousand something dollars rather than almost $400,000 by accounting information users. Thus, $399,000 may be perceived by accounting information users to be much lower than $400,000, which leads to a much lower market value of the firm reporting $399,000 of earnings than its intrinsic value.

The other reason for rounding earnings numbers relates to the use of earnings for contractual purposes, known as the contractual parameter perspective. In considering the contractual parameter perspective, small changes in reported earnings near the contractual parameters may have disproportionally large cash flow effects presuming that the key contractual parameters are typically selected as rounded earnings numbers. For an example, a borrowing firm is required to maintain a debt to equity ratio of '1' or lower by the lender, any debt to equity ratio above that contractual parameter of '1' will cause a technical default on the loan, which may incur extremely high costs to the borrowing firm in various forms.

If managers' opportunistic behaviors of rounding earnings numbers exist, a natural extension of the inquiry can be whether firm characteristics affect mangers' behaviors with regard to earnings rounding. Skousen et. al. (2004) showed that the managerial effort to round earnings numbers is affected by the distance between earnings before management and the reference points. Jordan et. al. (2008) also addressed that the propensity to engage in rounding earnings numbers is related to some firm characteristics such as size, leverage, and profitability.

We explore managers' earnings manipulation through rounding earnings numbers using Korean data. To be specific, the two research objectives of this study are first to examine if managers' opportunistic rounding behaviors of earnings observed in previous studies [Carslaw (1988), Thomas (1989)] using other country data exist in Korean data. The second objective of this study is to examine if there is a relationship between the abnormal rounding behavior of earnings and the reporting entities' firm characteristics in Korean firms as found in previous studies [Skousen et. al. (2004) and Jordan et. al. (2008)].

The remainder of this paper is organized as follows: Section 2 documents literature reviews, followed by hypotheses developments in section three. Data analyses and results are discussed in section four, and a summary of the results and concluding remarks are addressed in the final section.

2. LITERATURE REVIEW

The study on rounding of earnings is, in general, an earnings management study, but different than traditional earnings management studies in two ways. First, one popular way to detect earnings management in many traditional earnings management studies is to identify significant incentives of managers to manage earnings and then test if the pattern of non-discretionary accruals, the proxy measures of earnings management, are consistent with the incentives. Hence the validity of their research findings is heavily dependent on how to

identify the significant incentives and how to measure non-discretionary accruals [Watts et. al. (1978), Ronen et. al. (1981), Healy (1985), and Young (1998)]. This issue does not exist in the study on rounding of earnings where earnings management is detected by abnormal behaviors of earnings numbers.

Another common way to detect earnings management in previous studies is to see if there is a disproportionally high frequency of positive information releases coinciding with a disproportionally low frequency of negative information releases [Burgstahler et. al. (1997, 2000), Degeorge et. al. (1999), and Das et. al. (2000)]. Negative information includes negative earnings, missing market expectations, decreasing earnings, fluctuating earnings, and so forth. However, the underlying assumption of avoiding negative information releases can be situation specific. For example, if managers expect to report negative information in any given reporting period, then they may exaggerate the negative information in that year to increase the probability of reporting positive information in the following periods (i.e., big bath phenomenon). This sort of managers' behavior may impair the validity of findings from earnings management studies using frequency. This issue does not exist in the study to examine earnings management through abnormally rounding earnings.

Brenner et. al. (1982) document that humans possess only a limited amount of memory, and that this memory is used to store the most relevant pieces of information. Human cognition relies on a key number, and a specific cognitive reference point, which is often used as a major benchmark [Gabor et. al. (1966); Poltrock et. al. (1984)]. For example, in the price $299, more emphasis will be placed on the first digit '2', less on the second digit '9', and so on so forth. In remembering numbers, people tend to round down rather than round up, i.e. $299 would be rounded down to $290 rather than rounded up to $300 because rounding up requires a more complicated process than rounding down does. In other words, $299 is more likely perceived as $290 something than as very close to $300 due to a limited memory capacity of the human brain. Carslaw (1988) reports that there is a much higher than expected frequency of zeros but lower than expected frequency of nines as the second digit of earnings numbers using New Zealand firm data. This reflects managerial efforts to improve the first digit of earnings numbers, the most important cognitive reference point, by manipulating the second digit of earnings numbers to avoid potential damages on firm values and firms' cash flows.

Thomas (1989) examines the rounding earnings numbers issue using extensive U.S. firm data. His primary goal is to investigate whether the abnormal distribution of certain digits of earnings numbers is particular to New Zealand or common to U.S. firms as well. He examines both positive and negative earnings firms, while Carslaw (1988) investigates positive earnings firms only. He finds that U.S. companies with positive earnings report more zeros and fewer nines than expected in the second digit of earnings numbers. He also shows that negative earnings firms exhibit just the opposite pattern; fewer zeros and more nines than expected. Caneghem (2002) replicates the Carslaw (1988) and Thomas (1989) studies using U.K firm data. He examines pre-tax earnings and reaches conclusions similar to the previous studies. He finds that management uses short-range discretionary accruals to get a higher first digit in earnings. Again using U.K. firm data, Caneghem (2004) also examines the role of audit quality to constrain managers from rounding the second digit in earnings numbers to achieve a higher first digit. He fails to find supporting evidence for this. Das et. al. (2003) reports that firms manipulate earnings so that they can round-up and report one more cent of earnings per share (EPS). They find evidence that firms are more likely to round-up when

managers ex ante expect to meet analysts' forecasts, report positive profits, or sustain recent performance through rounding up. Further, they provide evidence that working capital accruals are used to round-up EPS.

Regarding a relationship between firm characteristics and managers' rounding earnings numbers behaviors, Skousen et. al. (2004) document that the greater the distance of pre-rounded numbers from the key reference point, the less likely managers will choose to round earnings to achieve that reference point. Jordan et. al. (2008) find that small firms manage earnings by rounding earnings numbers more aggressively than large firms do. They also find that low profit firms generally engage in these manipulative activities more aggressively than high profit firms do.

3. HYPOTHESES DEVELOPMENTS

With regard to managers' opportunistic behaviors of rounding earnings numbers, Carslaw et. al. (1988) and Thomas et. al. (1989) find that there are abnormal distributions of the second digit of earnings numbers in New Zealand and U.S.A.. Due to the limited capacity of human memory [Brenner et. al. (1982)] and preference of high earnings, firms are more likely to emphasize the first digit of earnings numbers the most, and hence the first digit should be the key cognitive reference point of earnings numbers. To avoid disproportionally severe damages on firm values and/or firms' cash flows due to an unduly lower earnings perception by the users [Thomas et. al. (1989)], mangers may make it a priority to change the first digit of earnings numbers by rounding the second digit to achieve a desirable reference point. Therefore, this leads to what would be a disproportionally high frequency of zeros and low frequency of high numbers (e.g., eight and nine) in the second digit of earnings numbers in profit making firms, while there would be disproportionally high frequency of high numbers and low frequency of zeroes in the second digit of earnings numbers in loss taking firms. Two testable hypotheses from this prediction would be:

Hypothesis 1: *There is a higher frequency of zeroes and a lower frequency of high numbers in the second digit of earnings numbers in profit making firms than the expected frequency if there is no rounding of earnings numbers.*

Hypothesis 2: *There is a lower frequency of zeroes and a higher frequency of high numbers in the second digit of earnings numbers in loss taking firms than the expected frequency if there is no rounding of earnings numbers.*

It has been well documented that highly leveraged firms are more susceptible to violations of debt covenants and hence more likely to engage in earnings management to avoid hefty costs from covenant violations [Watts et. al. (1986); Daley et. al. (1983); Johnson et. al. (1988); Balsam et al. (1995); LaBelle (1990)). Since rounding earnings numbers is one way to manage earnings, the amount of financial leverage present in firms may affect managers' rounding behaviors of earnings numbers. If mangers of highly leveraged firms have stronger pressure to prevent debt covenant violations, they will more aggressively engage in earnings management through rounding earnings numbers. As a result, there would be stronger presence of abnormal distribution of the second digit in earnings numbers of highly leveraged firms than in those of low leveraged firms. A testable hypothesis from this prediction would be:

***Hypothesis 3**: Earnings manipulation through rounding the second digit of earnings numbers is positively associated with financial leverage positions.*

Prior studies examined the relationship between firms' operational performances and their engagement in earnings management. They have found that in general, poor performing firms tend to have more incentives to engage in earnings management, and hence actually do so [Kinney et. al. (1989); Balsam et al. (1995); DeFond et. al. (1997); Yoon et. al. (2002)]. Similarly, Burgstahler et. al. (1997) suggest that firms manipulate earnings upward to prevent reporting negative earnings or declining earnings. DeAngelo et.al. (1994) address that sustained weak performances can limit managers' earnings management opportunities. In sum, firms' operational performances may have a strong influence in managers' earnings management. Specifically, poor performing firms may have a stronger incentive to manage earnings to achieve the reference point than well performing firms do. A testable hypothesis from this prediction would be:

***Hypothesis 4:** Earnings manipulation through rounding the second digit of earnings numbers is negatively associated with firms' operating performances.*

Watts et. al. (1986) suggest that, relative to small firms, large firms face more public scrutiny and hence tend to have better monitoring systems in place to ensure accounting information quality, including earnings quality, which leaves less room for earnings management. Aharony (1993) also provides evidence that smaller firms manipulate earnings more diligently than larger firms do. A testable hypothesis from this prediction would be:

***Hypothesis 5:** Earnings manipulation through rounding the second digit of earnings numbers is negatively associated with the firm size.*

Because of the Big 4 auditors' "deep pockets" and their huge exposure to litigation risks, they may take a more conservative approach to dealing with their clients' questionable transactions than non-big 4 auditors. Craswell et al. (1995) note that Big 4 auditors may be able to provide higher quality audits than non-Big 4 auditors because the former can devote more resources to staff training and developing industry expertise than non-Big 4 auditors. Krishnan (2003) suggests that because of their size, relative to Non-Big 4 auditors, Big 4 auditors are in a better position to question or negotiate with clients who attempt to adopt aggressive accounting policies. Big 4 auditors can absorb the financial loss associated with losing an individual client easier than Non-Big 4 auditors. Because of the stated above, Big 4 auditors may be able to enforce preventive and corrective measures for earnings managements more effectively than Non-Big 4 auditors. A testable hypothesis from this prediction would be:

***Hypothesis 6:** Earnings manipulation through rounding the second digit of earnings numbers is more pronounced in firms with Non-Big 4 auditors than those with Big 4 auditors.*

4. DATA ANALYSES AND RESULTS

To investigate the above-mentioned research questions, we collected financial reporting data of 1,634 public companies and 14,380 private companies in Korea for 10 years, from 2001 through 2010. The data was obtained from the KISVALUE database.

Following previous studies in this line of research, the expected frequencies of the digits in earnings numbers are calculated using Benford's law [See Carslaw et. al. (1988); Thomas et. al. (1989); Jordan et. al. (2008); Benford (1938)]. Intuitively, it is plausible that each number from 1 through 9 would have the same chance of occurring in the first digit of a number, i.e. a probability of one-ninth. Likewise, each number from zero through nine would also have the same chance of occurring in the other digits of a number, i.e. a probability of one-tenth. However, lower numbers have higher frequencies than higher numbers in each digit of a number according to Benford' law. The chance of having '1' in the first digit is about 30%, while chance of having '9' in the same digit is only about 5%.

In spite of the counter intuitive nature of Benford's law, Varian (1972) suggested that the law could be used to detect possible fraud in lists of socio-economic data because a simple comparison of the digit frequency distribution from the data with the expected distribution of the digit according to Benford's law ought to bring to light any anomalous results. Nigrini (1999) also showed that Benford's law could be used in forensic accounting and auditing as an indicator of accounting and expenses fraud. Appendix A provides a summary and a graph of Benford's expected frequencies for the first, second, and third digits in a number.

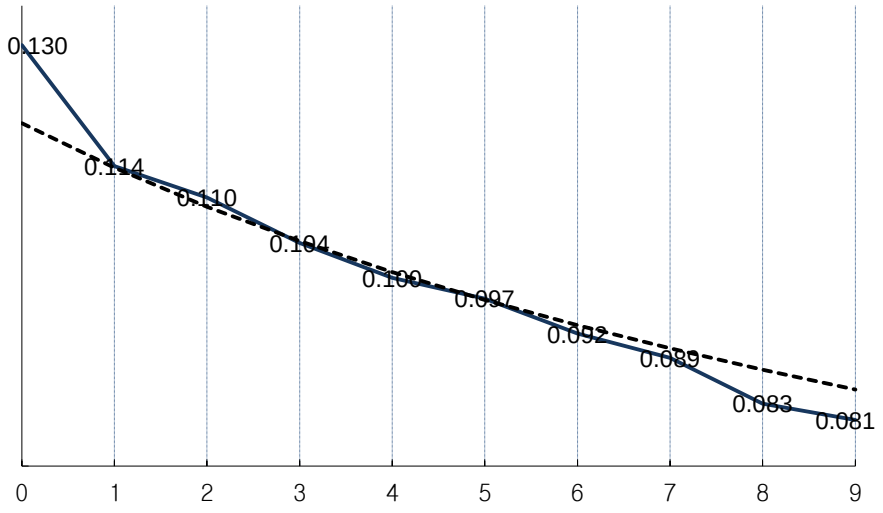
To test Hypotheses 1 and 2, that Korean firms also exhibit an abnormal distribution of the second digit in earnings numbers to achieve the cognitive reference point, observed frequencies of the second digit in earnings numbers are compared with the Benford's expected frequencies in the absence of earnings management. If observed frequencies of the second digit in earnings numbers do not conform to the Benford's expected frequencies, it may indicate that the second digit in earnings numbers are managed to achieve the cognitive reference point. Observed frequencies, expected frequencies of the second digit in earnings numbers of positive earnings firms, and comparison Z-statistics are presented in Table 1. The number '0' has statistically significantly higher presence in the second digit of earnings numbers than expected, while the numbers '8' and '9' have statistically significantly lower presence in the second digit of earnings numbers than expected, supporting Hypothesis 1.

Table 1: Second digit frequencies for positive earnings firms

Number	Observed #	Observed%	Expected%	difference	Z value	
0	14327	0.1299	0.1197	0.0102	10.407	**
1	12589	0.1141	0.1139	0.0002	0.217	
2	12136	0.1100	0.1088	0.0012	1.250	
3	11484	0.1041	0.1043	(0.0002)	0.259	
4	10982	0.0995	0.1003	(0.0008)	0.850	
5	10683	0.0968	0.0967	0.0001	0.160	
6	10180	0.0923	0.0934	(0.0011)	1.253	
7	9834	0.0891	0.0904	(0.0012)	1.406	
8	9175	0.0832	0.0876	(0.0044)	5.178	**
9	8941	0.0810	0.0850	(0.0040)	4.714	**
	110331		1.0000			

Z value = (|difference|-1/2N)/[{Expected%*(1-Expected%)}/N]$^{0.5}$, N=110331

Picture 1: Second digit frequencies for positive earnings firms



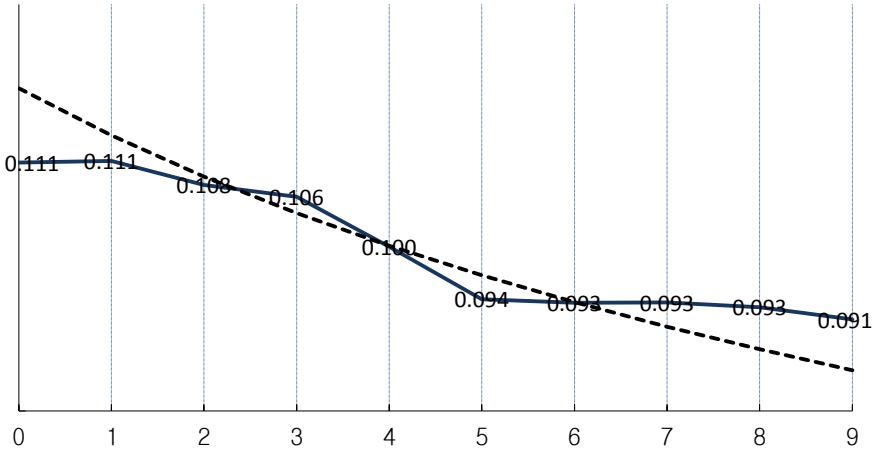
Observed frequencies, expected frequencies of the second digit in earnings numbers of negative earnings firms, and comparison Z-statistics are presented in Table 2. The number '0' has statistically significantly lower presence in the second digit of earnings numbers than expected, while the numbers '8' and '9' have statistically significantly higher presence in the second digit of earnings numbers than expected, supporting Hypothesis 2.

Table 2: Second digit frequencies for negative earnings firms

Number	Observed #	Observed %	Expected%	difference	Z value	
0	3264	0.1105	0.1197	(0.0091)	4.828	**
1	3270	0.1107	0.1139	(0.0031)	1.691	
2	3183	0.1078	0.1088	(0.0010)	0.554	
3	3140	0.1063	0.1043	0.0020	1.122	
4	2958	0.1002	0.1003	(0.0001)	0.065	
5	2768	0.0937	0.0967	(0.0029)	1.697	
6	2755	0.0933	0.0934	(0.0001)	0.029	
7	2756	0.0933	0.0904	0.0030	1.781	
8	2739	0.0928	0.0876	0.0052	3.146	**
9	2694	0.0912	0.0850	0.0062	3.833	**
	29527		1.0000			

Z value = (|difference|-1/2N)/[{Expected%*(1-Expected%)}/N]$^{0.5}$, N=29527

Picture 2: Second digit frequencies for negative earnings firms



The second issue addressed in the study is whether the propensity to round the second digit of earnings numbers is related to firm characteristics such as firm size, financial leverage, operating performance, and auditor quality: i.e., Hypotheses 3, 4, 5, and 6, respectively. To test these hypotheses, sample firms are divided into "managed" firms and "unmanaged" firms. The managed firms are firms which have zeros in the second digit of earnings numbers and are presumed to round the second digit of earnings numbers to achieve the reference point, whereas the unmanaged firms are those with eights or nines in the second digit and are presumed not to round the second digit of earnings numbers. Then, firm characteristics of managed firms are compared with those of non-managed firms. In Table 3, mean values of the firm characteristics of the managed firms, and of the unmanaged firms, differences in mean values of the firms characteristics between the two groups of firms, together with comparison t-values, and corresponding p-values are presented. The above-mentioned values of positive earnings firms are presented in Panel A of Table 3, while those of negative earnings firms are shown in Panel B of Table 3.

Hypothesis 3 states that earnings manipulation through rounding the second digit of earnings numbers is positively associated with financial leverage position. To test this hypothesis, we measure financial leverage using "total liabilities to total assets ratio." Among positive earnings firms, the mean debts to total assets ratio of the managed firms is higher than that of the unmanaged firms by 0.0048, which is statistically significant at the confidence level of 8%, supporting Hypothesis 3 that highly leveraged firms are more likely to engage in earnings management through rounding earnings numbers than low leveraged firms are. On the other hand, among negative earnings firms, the mean debts to total assets ratio of managed firms is lower than that of the unmanaged firms by 0.0029, which is not statistically significant at any meaningful confidence level, failing to support Hypothesis 3.

Table 3: Differences in firm characteristics between managed and unmanaged firms for the second digit

Panel A: Positive Earnings Firms

Variable	Managed[1]	unmanaged[1]	Difference	t value[1]	Pr>|t|
Lev	0.5799	0.5751	0.0048	1.76	0.0787
ROA	0.0881	0.0915	-0.0034	-3.34	0.0008
Size	23.619	23.655	-0.0360	-2.27	0.0232
Big4	0.3453	0.3486	-0.0033	-0.52	0.6009

Panel B: Negative Earnings Firms

Variable	Managed[2]	unmanaged[2]	Difference	t value	Pr>|t|
Lev	0.7883	0.7912	-0.0029	-0.36	0.7204

[1] The issue of equality of variances is considered for using t-test of mean difference between managed and unmanaged firms. Because the probabilities of significance of equality of variances for Lev, ROA, and Size are all smaller than 0.1, the variances seem to be unequal. Thus, the results are those from Satterthwaite t-test, not from pooled variance t-test.

ROA	-0.0560	-0.0520	-0.0040	-1.36	0.1752
Size	23.794	23.660	0.1340	4.09	<.0001
Big4	0.3250	0.3019	0.0231	1.97	0.0485

[1.] Earnings are assumed to be 'managed' when the second digit of earnings number is '0', whereas assumed to be 'unmanaged' when the second digit of earnings number is '8' or '9'.
[2.] Earnings are assumed to be 'managed' when the second digit of earnings number is '8' or '9', whereas assumed to be 'unmanaged' when the second digit of earnings number is '0'.

(Definition of variables)
Lev: Total liabilities/Total assets
ROA: Operating income/Total assets
Size: Ln(Total assets)
Big4: it takes 1 when a firm's auditor is Big4 accounting firm, otherwise 0

To test Hypothesis 4 that earnings manipulation through rounding the second digit of earnings numbers is negatively associated with firms' operating performances, the operating performance is measured using "operating income to total assets ratio (called ROA here after)." For positive earnings firms, mean ROA of the managed firms is lower than that of the unmanaged firms by 0.0034, which is not statistically significant at any meaningful confidence level. For negative earnings firms, mean ROA of managed firms is lower than that of the unmanaged firms by 0.0040, which is not statistically significant at any meaningful confidence level, again. In sum, the results fail to support Hypothesis 4 that poor performing firms are more likely to engage in earnings management through rounding the second digit of earnings numbers.

To test Hypothesis 5 that earnings manipulation through rounding the second digit of earnings numbers is negatively associated with the firm size, the firm size is measured by the natural log of total assets (called SIZE here after). Among positive earnings firms, the mean SIZE of the managed firms is lower than that of the unmanaged firms by 0.0360, which is statistically significant at the confidence level of 3%, supporting Hypothesis 5 that small firms are more likely to engage in earnings management than large firms are. On the other hand, among negative earnings firms, the mean SIZE of the managed firms is larger than that of the unmanaged firms by 0.1340, which is statistically significant at the confidence level of 1%. Contrary to Hypothesis 5, the results indicate that large firms do more actively engage in earnings managements than small firms do when they report negative earnings.

To test Hypothesis 6 that earnings manipulation through rounding the second digit of earnings numbers is more pronounced in the firms with Non-Big 4 auditors than those with Big 4 auditors, we use a dummy variable whose value is '1' if a firm's auditor is a Big 4 accounting firm or '0' if not (called BIG 4 here after). Among positive earnings firms, the mean BIG 4 of managed firms is lower than that of the unmanaged firms by 0.0033, which is not statistically significant at any meaningful confidence level. The results, therefore, fail to support Hypothesis 6 that firms using Non-Big 4 auditors are more likely to engage in earnings management than firms using Big 4 auditors are. On the other hand, among negative earnings firms, the mean BIG 4 of the managed firms is higher than that of the unmanaged firms by 0.0231, which is statistically significant at the confidence level of 5%. The results provide evidence that firms using Big 4 auditors do more aggressively engage in earnings management through rounding the second digit of earnings numbers than firms using Non-Big 4 auditors when firms report losses.

Over the last couple of decades, there are ever increasing regulations and oversight actions being introduced over accounting information preparations & disclosures, audits, and internal control systems, in order to improve accounting information quality and quantity in Korea. It would, therefore, be worthwhile to assure if managers opportunistic earnings management continue today, particularly in light of the heightened scrutiny managers face to present fair financial reporting. For this, the samples are divided into the first 5 years (2001-2005) and the second 5 years (2006-2010), presuming that the second five years were under more stringent scrutiny than the first five years. Then, rounding behaviors of earnings numbers for the first 5 years are compared to those for the second five years. In Table 4, the observed frequencies and expected frequencies of the second digit in earnings numbers, differences between observed frequencies and expected frequencies, and comparison Z-statistics are presented. For the first 5 year period, the number '0' has a statistically significantly higher presence in the second digit of earnings numbers than expected, while the numbers '8' and '9' have statistically significantly lower presence in the second digit of earnings numbers than expected. The same phenomena happened over the second 5 year period, indicating that earnings management through the rounding of earnings numbers continue over the entire 10 year sample period, and there is no significant difference between the two 5 year periods in regards to these opportunistic behaviors. The heightened scrutiny that managers face to disclose more and better accounting information may not successfully resolve earnings management through rounding earnings numbers.[2]

Table 4: Description of the second digit frequencies by year

Panel A: Year 2001 to 2005

Number	Observed #	Observed %	Expected%	difference	Z value	
0	6878	0.1323	0.1197	0.0126	8.8394	**
1	5978	0.1150	0.1139	0.0011	0.7638	
2	5689	0.1094	0.1088	0.0006	0.422	
3	5415	0.1041	0.1043	-0.0002	0.1371	
4	5135	0.0988	0.1003	-0.0016	1.1754	
5	4964	0.0955	0.0967	-0.0012	0.9314	
6	4761	0.0916	0.0934	-0.0018	1.4115	
7	4643	0.0893	0.0904	-0.0011	0.8354	
8	4332	0.0833	0.0876	-0.0043	3.4294	**
9	4204	0.0808	0.085	-0.0042	3.3873	**
	51999		1.000			

[2]Comparisons between rounding earnings numbers by public firms vis-à-vis private firms are also made but no statistically significant differences between the two groups of firms are found.

Panel B: Year 2006 to 2010

Number	Observed #	Observed %	Expected%	difference	Z value	
0	7449	0.1277	0.1197	0.0080	5.9612	**
1	6611	0.1133	0.1139	-0.0006	0.4162	
2	6447	0.1105	0.1088	0.0017	1.3138	
3	6069	0.1040	0.1043	-0.0003	0.2205	
4	5847	0.1002	0.1003	-0.0001	0.0521	
5	5719	0.0980	0.0967	0.0014	1.1063	
6	5419	0.0929	0.0934	-0.0005	0.3836	
7	5191	0.0890	0.0904	-0.0014	1.138	
8	4843	0.0830	0.0876	-0.0045	3.8763	**
9	4737	0.0812	0.085	-0.0038	3.2769	**
	58332		1.000			

Following Skousen et. al. (2004)'s suggestion that the key reference points of earnings numbers may not be limited to the first digit, earnings management through rounding the third digit of earnings numbers are examined using the same methods as those for the second digit analyses. It is assumed that the first 2 digits of earnings numbers will be the key cognitive reference points. Observed frequencies and expected frequencies of the third digit, the differences, and comparison Z-statistics are presented in Table 5. The above-mentioned values of positive earnings firms are presented in Panel A of Table 5, while those of negative earnings firms are presented in Panel B of Table 5. Among positive earnings firms, the number '0' shows statistically significantly higher frequency than expected, while the numbers '5', '6', '7', and '9' show significantly lower frequencies than expected under Benford's law. Among negative earnings firms, the number '0' shows significantly higher frequency than expected, while all the other numbers do not show any significant deviations from the expected. In sum, rounding behaviors on the third digit are different than those on the second digit of earnings numbers.

Table 5: Description of the third digit frequencies

Panel A: firms with positive earnings

Number	Observed #	Observed %	Expected %	difference	Z value	
0	12724	0.1153	0.1018	0.0135	14.871	**
1	11258	0.1020	0.1014	0.0007	0.724	
2	11147	0.1010	0.1010	0.0001	0.0613	
3	11129	0.1009	0.1006	0.0003	0.3222	
4	10899	0.0988	0.1002	-0.0014	1.5367	
5	10725	0.0972	0.0998	-0.0026	2.8544	**
6	10658	0.0966	0.0994	-0.0028	3.1046	**
7	10559	0.0957	0.0990	-0.0033	3.6829	**
8	10708	0.0971	0.0986	-0.0016	1.7637	
9	10524	0.0954	0.0983	-0.0029	3.2102	**
	110331		1.0000			

Panel B: firms with negative earnings

Number	Observed #	Observed %	Expected %	difference	Z value	
0	3116	0.1055	0.1018	0.0037	2.1193	*
1	2944	0.0997	0.1014	-0.0017	0.9415	
2	2995	0.1014	0.1010	0.0005	0.2529	
3	2933	0.0993	0.1006	-0.0012	0.6988	
4	2917	0.0988	0.1002	-0.0014	0.7842	
5	2885	0.0977	0.0998	-0.0021	1.183	
6	2936	0.0994	0.0994	0.0000	0.0093	
7	2974	0.1007	0.0990	0.0017	0.9695	
8	2919	0.0989	0.0986	0.0002	0.1156	
9	2908	0.0985	0.0983	0.0002	0.1166	
	29527		1.000			

Z value = (|difference|-1/2N)/[{Expected%*(1-Expected%)}/N]$^{0.5}$

Regarding the relationship between the propensity to round the third digit of earnings numbers and firm characteristics such as firm size, financial leverage position, operating performance, and auditor quality, summary statistics are presented in Table 7. The financial leverage position of managed firms are significantly higher than those of unmanaged firms, while operating performances (ROA) of managed firms are significantly lower than those of unmanaged firms. The size of managed firms are significantly smaller than that of unmanaged firms, but there is no significant difference in hiring Big 4 auditors between managed firms and unmanaged firms.

Table 6: Differences in firm characteristics between managed and unmanaged firms For the 3rd digit

Variable	Managed[1]	unmanaged[1]	difference	t value	Pr>|t|
Lev	0.5912	0.5761	0.0151	6.19	<.0001
ROA	0.0870	0.0906	-0.0036	-4.08	<.0001
Size	23.386	23.669	-0.283	-18.85	<.0001
Big4	0.3448	0.3455	-0.0007	-0.12	0.9029

[1.] Earnings are assumed to be 'managed' when the third digit of earnings number is '0', whereas assumed to be 'unmanaged' when the third digit of earnings number is larger than 4.

(Definition of variables)

Lev: Total liabilities/Total assets
ROA: Operating income/Total assets
Size: ln(Total assets)
Big4: it takes 1 when the firm's auditor is Big4 accounting firm, otherwise 0

5. SUMMARY AND CONCLUSION

We investigated the following two questions on managers' earnings manipulation through rounding earnings numbers using Korean data. First, we examined whether Korean firms manage earnings through rounding the second digit of earnings numbers to achieve the reference point. Second, since the answer to the first research question turned out to be yes, we examined if there is a relationship between the abnormal rounding behavior of earnings numbers and the reporting entities' firm characteristics, such as financial leverage position, operating performance, size, and audit quality.

The results found in this study suggest the followings: First, Korean firms also round the second digit of earnings numbers to raise the value of the first digit by one, the key reference point. This holds true for both positive earnings firms and negative earnings firms. Second, among positive earnings firms, highly leveraged firms engage in earnings management through rounding earnings numbers more actively than low leveraged firms. However, financial leverage positions may not affect managers' earnings management through rounding the second digit among negative earnings firms. Third, operating performances may affect the mangers' efforts to round the second digit in order to achieve the reference point among positive earnings firms, while they may not affect the rounding behaviors among negative earnings firms. Fourth, among positive earnings firms, small firms engage in earnings management more actively than large firms do, while among negative earnings firms, large firms do more actively engage in earnings management than small firms. Fifth, on the contrary to our prediction, firms using Big 4 auditors do more aggressively engage in earnings management by rounding earnings than firms using Non-Big 4 auditors when firms report losses. But there is no statistically significant evidence for or against this prediction among positive earnings firms.

The results found in this study are robust across different measures of variables, time periods, and capital markets. In this study, we provide preliminary evidence on the manipulative behaviors of rounding the second and third digits of earnings numbers in Korean firms, their associations with firm characteristics, and the different behaviors of rounding earnings numbers in positive earnings firms relative to negative earnings firms, all of which are potential contributions of this study and to the literature of earnings management.

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Appendix A:

Benford's law indicates that the expected frequency of number d_1 as the first digit is: $log_{10}(1+1/d_1)$.
The expected frequency of number d_1 as the first digit and number d_2 as the second digit is: $Log_{10}(1+1/d_1d_2)$. The expected frequency of number d_2 as the second digit is: $\sum_{d1=1}^{9} \log(1+\frac{1}{d1d2})$

Benford's Expected Digital Frequencies

Digit	0	1	2	3	4	5	6	7	8	9
1st digit(d1)	n/a	0.3010	0.1761	0.1249	0.0969	0.0792	0.0669	0.0580	0.0512	0.0458
2nd digit(d2)	0.1197	0.1139	0.1088	0.1043	0.1003	0.0967	0.0934	0.0904	0.0876	0.0850
3rd digit (d3)	0.1018	0.1014	0.1010	0.1006	0.1002	0.0998	0.0994	0.0990	0.0986	0.0983

$p(d1)=\log(1+1/d1)$ $\quad d1 = (1,2,3, \dots ,9)$

$p(d2)=\sum_{d1=1}^{9} \log(1+1/d1d2)$ $\quad d2= (0,1,2, \dots , 9)$

$p(d3)=\sum_{d1d2=10}^{99} \log(1+1/d1d2d3)$ $\quad d3= (0,1,2, \dots , 9)$

Benford's Expected Digital Frequencies for 2nd and 3rd digi