Round-Off Bias in Earnings-Per-Share Calculations

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Abstract

Using data available on Standard and Poor's Compustat Data Files, this study provides overwhelming evidence that managers of public corporations bias the round-off of EPS calculations. In addition, the study reports that the incidence of EPS round-ups is associated with factors affecting differences in the "value" of EPS round-ups to managers, e.g., differences in Price-Earnings ratios, differences in absolute EPS levels, and whether a profit or loss is reported.

I Introduction

Carslaw [1988] and Thomas [1989] report that unusual patterns exist in the second-most-left digit of earnings numbers reported by public companies. For example, both Carslaw and Thomas report that zeros occur more frequently than expected as the second-most-left digit in reported earnings numbers, and that nines occur less frequently. In addition, Thomas reports that the last digit of an earnings-per-share statistic is zero or five more frequently than would be expected by chance.

This study extends aspects of Thomas' work concerning unusual patterns in reported EPS statistics, and addresses a different question: Do managers of public companies tend to bias the round-off of earnings-per-share calculations? The results of this study, which are based upon data available on Standard and Poor's 1990 COMPUSTAT data files, provide overwhelming evidence that managers of public corporations are more likely to round-up, rather than to round-down, the last decimal presented in an EPS calculation. In addition, this study reports that the incidence of EPS round-ups is positively associated with the "value" of the round-up to the manager. For example, EPS calculations of firms with high Price/Earnings ratios are rounded up more frequently than EPS calculations of firms with low Price/Earnings ratios; also, EPS calculations of firms with low absolute EPS statistics are rounded up more frequently than EPS calculations of firms with high absolute EPS statistics.

The remainder of this manuscript is organized as follows. Section II provides background information relevant to the issues addressed in the paper. Section III states the study's research questions and defines the study's variables. Section IV develops the study's hypotheses and reports the study's results. Concluding observations are provided in Section V.

II Background Information

Arithmetically, the calculation of earnings per share involves dividing a numerator by a denominator to produce a quotient. In the United States, almost all EPS statistics are expressed on the basis of dollars and whole cents. [1] Hence, the second positional digit in an EPS decimal expansion is almost always a rounded number. To illustrate, assume a firm has income available to common shareholders of $48,000,000 and a weighted average of common and common equivalent shares of 70,000,000. Under these assumptions, the firm's actual earnings per share (calculated to four decimal places) is $.6857; however, the firm would report earnings per share of $.69 in its financial statements by rounding the second positional digit in the decimal expansion, 8, up to 9.[2]

To the author's knowledge, there is nothing in extant accounting literature which deals directly with strategies a manager may employ to bias the round-off of an EPS decimal expansion. However, for most large public companies, it does not appear that it would be difficult to bias the round-off of an EPS decimal expansion if a manager was motivated to do so. Indeed, it is widely believed that almost all large public companies--the types of firms analyzed in this study--have accounts which can be manipulated to produce small changes in income. Thus, if a manager observed that an unbiased EPS calculation resulted in a round-down of earnings per share, and if a round-up of earnings per share was desired, it is reasonable to believe that income could normally be manipulated by an amount sufficient to produce the desired round-up.

Various factors may affect the likelihood that a manager may round-off an EPS calculation in a biased fashion. (As used herein, an EPS calculation is said to have been rounded-off in a biased fashion if techniques

were employed whose purpose was to permit the firm's EPS statistic to be rounded up.) Some of these factors might include the manager's integrity, the control consciousness within the firm, the manager's attitude towards financial-reporting "gimmickry," and whether the idea of biasing the EPS round-off ever occurred to the manager. An additional factor, and a factor that forms the basis for some of the study's tests, is the perceived benefit that may accrue to the manager from biasing the EPS round-off. Indeed, as subsequently reported, there appears to be a definite relationship between the likelihood that an EPS statistic will be rounded up and the "value" of the round-up to the manager.

III Research Questions and Variable Definitions

This study addresses two interrelated questions: (1) do managers, in general, round-off EPS calculations in a biased fashion, and (2) is the incidence of biased EPS round-offs associated with factors affecting the "value" of the round-up to the manager? Before answering either of these questions, it will be necessary to define the study's variables and to establish the overall orientation of the analysis.

Variable Definitions.

Table 1 provides definitions of all variables and filters used in this study. Discussion of these variables and filters follows.

ROUNDUP$_{i,t}$. The variable ROUNDUP$_{i,t}$ forms the basis for most of the statistics presented in this study. As indicated in Table 1, ROUNDUP$_{i,t}$ is coded as

1 if EPSREPT$_{i,t}$ > EPSCALC$_{i,t}$, and
0 otherwise,

where EPSREPT$_{i,t}$ represents firm i's primary EPS statistic reported by the firm on its income statement for period t, and EPSCALC$_{i,t}$ represents firm i's primary EPS statistic calculated by dividing (i) income available to common shareholders by (ii) the number of common and common equivalent shares used to calculate primary earnings per share. (See Table 1 for additional details.)

Various comments are relevant concerning the coding of ROUNDUP. First, ROUNDUP is defined so that a round-down of a loss-per-share statistic is coded in the same way as a round-up of an profit-per-share statistic.[3] This coding convention is considered appropriate since reducing a negative number is conceptually equivalent to increasing a positive number. Second, all results presented in this study are based upon firms' primary EPS statistics before extraordinary items and discontinued operations. This particular EPS statistic is analyzed because it probably is the single most important EPS statistic for purposes of valuing the firm and assessing managerial effectiveness. Finally, although isolated exceptions exist, the data required to compute EPSCALC$_{i,t}$ appear to be routinely disclosed by corporations in reports to shareholders or in filings with the SEC.[4]

Filter Variables.

Various filters were used in selecting observations for analysis. Discussion of these filters follows.

USABLEOB$_{i,t}$. The filter USABLEOB (for "usable observation") ensures that only usable observations are analyzed. As indicated in Table 1, an observation is not considered usable if any of the following conditions exist:

a. EPSREPT$_{i,t}$ is reported to three decimal places,
b. EPSREPT$_{i,t}$ = EPSCALC$_{i,t}$, or
c. EPSREPT$_{i,t}$ - EPSCALC$_{i,t}$ $\geq$ \$|.005|.

The first condition excludes observations where the firm reported EPS statistics to three decimal places. Although such instances are rare (and confined almost exclusively to the first few years following the effective date of ABP Opinion No. 15), three-decimal observations are not comparable to two-decimal observations for purposes of this study. The second condition excludes observations where EPSREPT$_{i,t}$ exactly equals EPSCALC$_{i,t}$ (and hence where no rounding of EPS calculations occurred). The third condition excludes inconsistent observations, i.e., where difference between a firm's reported earnings per share, EPSREPT$_{i,t}$, and calculated earnings per share, EPSCALC$_{i,t}$, equals or exceeds .005. The rationale for this condition requires elaboration, and is discussed below.

At first blush, one might presume that the absolute value of the difference between EPSREPT$_{i,t}$ and EPSCALC$_{i,t}$ would be $\leq$ \$.005 in almost all instances. However, this difference can actually exceed \$|.005| for a variety of reasons, including nondisclosure of relevant data by firms, improper encoding of information by Standard and Poor's COMPUSTAT Service, round-off inconsistencies involving the presentation of per-share effects of different income components (e.g., when the rounded per-share effects of income before an extraordinary item and an extraordinary item do not equal net earnings), round-off errors made by managers, and the sheer complexity of the computations and disclosures in some instances. However, the most common reason why the difference between EPSREPT$_{i,t}$ and EPSCALC$_{i,t}$ may exceed \$|.005| appears to be due to the use of rounded data in the computation of EPSCALC$_{i,t}$ in the first place. That is, the numerator and denominator in EPSCALC$_{i,t}$ are reported by COMPUSTAT to a preci

Table 1
Variable Definitions

$ROUNDUP_{i,t}$	Coded as 1 for firm i in period t if $EPSREPT_{i,t}$ is greater than $EPSCALC_{i,t}$. Otherwise, coded as 0.
$EPSREPT_{i,t}$	COMPUSTAT Annual Data Item 58, representing firm i's primary EPS number (before extraordinary items and discontinued operations) reported for period t.
$EPSCALC_{i,t}$	Primary EPS for firm i in period t, calculated as follows: $ERNAVAL_{i,t}$ / $WTDSHRS_{i,t}$.
$ERNAVAL_{i,t}$	Firm i's earnings available to common shareholders in period t, adjusted for common stock equivalents (COMPUSTAT Annual Data Item 20).
$WTDSHRS_{i,t}$	Firm i's common and common equivalent shares used to calculate primary EPS in period t (COMPUSTAT Annual Data Item 54).
$USABLEOB_{i,t}$	A filter for usable observations, coded as 0 (for unusable) if any of the following conditions are met: 1. $EPSREPT_{i,t}$ is reported to three decimal places, 2. $EPSREPT_{i,t}$ = $EPSCALC_{i,t}$, or 3. $EPSREPT_{i,t}$ - $EPSCALC_{i,t}$ $\geq$ $\$\|.005\|$. Otherwise, coded as 1 (for usable).
$EISHOWN_{i,t}$	Coded as 1 if an extraordinary item or discontinued operation is reported by firm i in period t. Otherwise, coded as 0.
$PERATIO_{i,t}$	Market value of firm i's common stock at end of period t, divided by primary EPS for firm i for period t (COMPUSTAT Annual Data Item 24 divided by Annual Data Item 58).

sion no greater than thousands of dollars, and this potential for computation imprecision is exacerbated when firms report information to a precision no greater than millions, or tenths of millions, of dollars. Hence, $EPSCALC_{i,t}$ itself is subject to round-off computation error, and these errors can produce observations where $CALCDIF_{i,t}$ exceeds $\$|.005|$.[5]

$EISHOWN_{i,t}$. The variable $EISHOWN_{i,t}$ (for "Extraordinary Item Shown") is applied to filter observations when an extraordinary gain or loss is reported by firm i in period t. As noted above, round-off inconsistencies may occur when the per-share effects of different income components (i.e., income before an extraordinary item and an extraordinary item) do not equal net earnings. Also, for some tests, observations may be filtered depending upon whether $EPSREPT_{i,t}$ or $EPSCALC_{i,t}$ are greater than zero. As discussed subsequently, managers' incentives to bias the round-off of loss-per-share statistics appears to be weaker than the incentives to bias round-offs of profit-per-share statistics.

Data Source.

All data presented in this study are based upon a July 1990 edition of Standard and Poor's Annual Primary, Secondary, and Tertiary Industrial COMPUSTAT data files. These computer-accessible files provide financial data for up to 20 years on approximately 2,500 public corporations listed on the New York Stock Exchange, American Stock Exchange, or traded over the counter.

IV--Data Analysis

Summary Statistics and Frequency Data.

Table 2 reports information relevant to the first question addressed in the study, i.e., do managers, in general, round-off EPS calculations in a biased fashion? As indicated in Panel 1 of Table 2, annual profit-per-share statistics of companies reporting no extraordinary items were found to be rounded up at a rate of .551. The significance of this proportion can be tested using the normally distributed Z-statistic described in Fleiss [1981, 13]. Under the assumption that managers are equally likely to round-up EPS calculations as to round them down, Z calculates to 15.5, from which it may be inferred that managers are more likely to round-up, rather than to round-down, EPS calculations.[6]

Panel 2 of Table 2 provides frequency statistics, and a related histogram, for the third digit in the EPS decimal expansion. (Recall from endnote 2 that the third digit in a decimal expansion is the third digit after the decimal point.) These statistics and histogram supplement the statistics presented in Panel 1. In particular, the histogram graphically illustrates the fact that the occurrence frequency of third digits in EPS

Table 2
Summary Statistics and Histogram -- Annual Eps Data
(See Table 1 for variable and filter definitions)

(Filters: $USABLEOB_{i,t} = 1$, $EISHOWN_{i,t} = 0$, $EPSCALC_{i,t} \geq 0$.)

Panel 1 -- Summary Statistics

N	ROUNDUP FREQ.	Z
22,916	.551	15.5*

*Sig. at .0001 level that ROUNDUP = .500.

Panel 2 -- Third Digit in EPS Decimal Expansion -- Percent of Observations

0	1	2	3	4	5	6	7	8	9
11.5	9.7	8.9	8.1	6.7	10.5	11.5	11.1	10.5	11.5

Histogram of Frequency of Third Digits in EPS Decimal Expansions
(each .2% equals approximately one symbol)

3rd Digit	
0	**********
1	**********
2	**********
3	**********
4	**********
5	**********
6	**********
7	**********
8	**********
9	**********

[Note: The fact that observed third-digit frequencies monotonically decrease from 0 to 4 is additional evidence of the tendency for managers to bias the round-off of EPS decimal expansions. If managers did not bias EPS round-offs, one would expect each digit's frequency to be .100.]

decimal expansions decreases monotonically from 0 to 4, thereby providing additional evidence of the tendency for managers to bias the round-off of EPS calculations. [If managers did not bias EPS round-offs, one would expect a frequency of .100 for each third digit.][7]

Hypotheses.

The aggregate statistics presented in Table 2 provide convincing evidence that at least some managers bias the round-off of EPS calculations. This section reports results of tests undertaken to determine whether the incidence of EPS round-ups is associated with factors believed to affect the "value" of an EPS round-up to managers. Specifically, it is hypothesized that the incidence of EPS round-ups

1. is negatively associated with absolute levels of earnings per share,
2. is positively associated with price/earnings ratios, and
3. differs depending upon whether a profit, or loss, per share is reported.

A brief rationale for these hypotheses is provided below.

The decision to bias an EPS round-off is a conscious, discretionary act. Hence, the likelihood that a manager would bias an EPS round-off presumably would be related to the benefit that may accrue to the manager from a one-cent increase in reported earnings per share. One factor believed to affect this incremental value is the percentage change in EPS produced by a one-cent increase. Since this percentage change is inversely related to the size of the EPS statistic from which the change is calculated, it is reasonable to expect an inverse relationship to exist between (i) the likelihood a manager would bias an EPS round-off and (ii) the absolute level of the firm's EPS.

A second factor that may affect a manager's incentive

to bias an EPS round-off is the price-earnings ratio of the firm. Certainly, it is unlikely that a manager would specifically consider the firm's price-earnings ratio when deciding whether to manipulate an EPS round-off. However, it is not unreasonable to assume that P/E ratios act as reasonable proxies for differing degrees of pressures managers may feel to report increases in earnings per share. Since managers of high P/E firms probably feel greater pressures to report EPS increases than managers of low P/E firms, managers of high P/E firms have greater incentives to bias EPS round-offs than managers of low P/E firms. Hence, it seems reasonable to expect a direct relationship to exist between (i) the likelihood that a manager would bias an EPS round-off and (ii) the price-earnings ratio of the firm.

Finally, the incentives a manager has to bias an EPS round-off probably is influenced by whether a profit, or loss, per share is reported. Small changes in loss-per-share statistics are probably less important than small changes in profit-per-share statistics for purposes of valuing the firm or assessing managerial effectiveness. Hence, managers are expected to have weaker incentives to bias loss-per-share round-offs than profit-per-share round-offs. Thus, it seems reasonable to expect that the proportion of round-downs of loss-per-share statistics will be lower than the proportion of round-ups of profit-per-share statistics.

Loss-Per-Share Test Results.

Table 3 reports results of tests to determine whether the incidence of EPS round-off bias differs depending upon whether a profit, or loss, per share is reported. As reported in Table 3, loss-per-share statistics were rounded down at a frequency of .514 during the test years, while profit-per-share statistics were rounded up at a rate of .551. (These proportions are based upon the filters noted at the top of Table 3.) The significance of this difference, .037, can be tested using a Z-statistic suggested by Fleiss [1981, 30], which pools the combined variances of the two populations. As reported in Table 3, this Z-statistic calculates to 3.40 (which is significant at the .001), from which it may be inferred that managers are less likely to bias the round-offs of loss-per-share statistics than the round-offs of profit-per-share statistics.

Effects of Price-Earnings Ratios and Absolute EPS Levels.

Table 4 reports results of tests to determine whether EPS round-ups ($ROUNDUP_{i,t}$) are associated with price-earnings ratios ($PERATIO_{i,t}$) and absolute EPS levels ($EPSREPT_{i,t}$). (See Table 1 for variable definitions.)

Descriptive statistics for the above variables are provided in Table 4 for two different subpopulation groups: one where no price-earnings-ratio filter is applied, and another where a P/E filter of ≤ 25 is applied. An examination of these statistics indicates that the distribution of P/E ratios is significantly skewed and influenced by outlier observations when no P/E filter is applied (see Column 1 in Table 4), but that this distribution is substantially less skewed and less influenced by outliers when a P/E filter of ≤ 25 is applied (see Column 2). Accordingly, when performing tests of hypotheses in the no-P/E-filter case, a logarithmic relationship between P/E ratios and managers' incentives to round-up EPS statistics will be assumed. (A linear relationship will be assumed when a P/E filter of ≤ 25 is applied.)[8]

Table 3
Effects of Losses Per Share
upon Round-Up Frequencies
(See Table 1 for variable and filter definitions)

(Filters: $USABLEOB_{i,t} = 1$, $EISHOWN_{i,t} = 0$)

	N	ROUNDUP FREQ.	Z*
$EPSCALC_{i,t} \geq \$0$	22,916	.551	
$EPSCALC_{i,t} < \$0$	2,358	.514	
Difference		.037	3.40*

*Significant at .001 level.

Logit regression. The dependent variable in the research design is binary, i.e., either 0 or 1. Hence, it seems inappropriate to assume Ordinary Least Squares (OLS) estimation methods in testing relationships between $ROUNDUP_{i,t}$, price-earnings ratios, and EPS-size effects. Instead, a logistic (or "logit") regression model is assumed. Logit regression is reviewed in many econometric textbooks (including Johnston [1984, pp 419 to 428] and Myers [1986, 195 to 200]), is described at length in Aldrich and Nelson [1984], and is compared to OLS regression in Stone and Rasp [1991]. Essentially, the coefficients of a logit regression model, $b_0, b_1, \ldots, b_k$, yield the maximum likelihood estimate of the probability that $Y_i = 1$, conditioned on the values $X_{1i}, X_{2i}, \ldots X_{ki}$. Estimates of these conditional probabilities can be obtained from the logit regression coefficients, as follows:

$$\text{Prob}\,(Y_i = 1 \mid X_{1\ldots k}) = 1 / 1 + e^{-(b_0 + b_1X_{1i} + \ldots + b_kX_{ki})} \quad (1)$$

(Note that the range of a logistic function is constrained from 0 to 1, an essential property of a probability-estimating function.) Also, the significance of logit regression coefficients can be assessed in the usual

manner, i.e., by dividing the logit regression coefficient by its standard error and comparing the resulting statistic to a critical t-value [Nelson and Aldrich, 54].

Test results. Logit regression statistics concerning bivariate and multivariate relationships between and among $ROUNDUP_{i,t}$, $PERATIO_{i,t}$ (or ln $PERATIO_{i,t}$), and $EPSREPT_{i,t}$ are reported in the bottom portion of Table 4. An examination of these statistics indicates that (i) a negative relationship exists between $ROUNDUP_{i,t}$ and absolute EPS levels (see Eq. No. 1), (ii) a positive relationship exists between $ROUNDUP_{i,t}$ and price-earnings ratios (see Eq. Nos. 2 and 3), and (iii) these relationships are significant at the .0001 level. (As discussed above, a logarithmic relationship was assumed when no P/E filter was applied--see Eq. 2--and a linear relationship was assumed when a P/E filter of ≤ 25 was applied--see Eq. 3.)

Multivariate statistics concerning the joint effect that P/E ratios and absolute EPS levels have on $ROUNDUP_{i,t}$ are presented in Logit Eq. No. 4. As reported in Table 4, the sign of both coefficients conforms to expectations and both coefficients are significant at the .0001 level. Hence, based upon the bivariate and multivariate statistics presented in Table 4, it is concluded that the likelihood that a manager will round-up an EPS statistic is positively related to the firm's price/earnings ratio and negatively related to the absolute level of reported earnings per share.

Finally, as an aid in interpreting the results presented in Table 4, recall that logit regression coefficients can be used to generate estimates of the probability of a conditional event. Thus, assuming a well-specified model [9], and using the coefficients reported in Eq. No. 4 in Table 4, assume that two firms, Firms A and B, have earnings per share and P/E ratios, as follows:

Table 4
Effects of Absolute EPS Levels and Price-Earnings Ratios upon Round-Up Frequencies
(See Table 1 for variable and filter definitions)

(Filters: $USABLEOB_{i,t} = 1$; $PRICE_{i,t} > 0$; $EPSREPT_{i,t} > 0$, $EISHOWN_{i,t} = 0$)

Descriptive Statistics

	----Column 1---- No P/E ratio filter		----Column 2----- P/E ratio $\leq$ 25	
	Mean	Std dev	Mean	Std dev
	(n =21,942)		(n = 19,925)	
ROUNDUP	.554	.497	.552	.497
EPSREPT	2.44	2.06	2.61	2.07
PERATIO	17.0	54.8	10.5	4.9
ln PERATIO	2.39	.71	2.24	.49

Logit Regression Statistics

Dependent variable = $ROUNDUP_{i,t}$

Logit Eq. No.	Intercept and predictor variable(s)	Ex-pected sign	----Column 1---- No P/E ratio filter Coeff	Coeff / Std Err	----Column 2----- P/E ratio $\leq$ 25 Coeff	Coeff / Std err
1	INTERCEPT		.3252		.3274	
	EPSREPT	-	-.0447	-6.69*	-.0455	-6.50*
2	INTERCEPT		-.0499		-.2265	
	ln PERATIO	+	.1113	5.72*	.1944	6.60*
3	INTERCEPT		see		.0081	
	PERATIO	+	Column 2		.0207	7.07*
4	INTERCEPT				.1246	
	EPSREPT	-	see		-.0337	-4.62*
	PERATIO	+	Column 2		.0164	5.35*

*Significant at .0001 level.

Firm A: EPS of $ .75 and P/E ratio of 20
Firm B: EPS of $7.50 and P/E ratio of 10.

Under these assumptions, the probability is .605 that Firm A's EPS statistic would be rounded up, but only .509 that Firm B's EPS statistic would be rounded up. Computations for Firm A follow:

$$1 / 1 + e^{-\{.1246 + .75(-.0337) + 20(.0164)\}} = .605. \quad (2)$$

V Conclusion

This paper has provided evidence of a tendency for managers of U. S. public companies to bias the round-off of earnings-per-share calculations. As reported herein, EPS calculations are much more likely to be rounded up, rather than down. In addition, the likelihood that an EPS statistic would be rounded up was found to be positively associated with incentives managers have to bias EPS round-offs. Of particular interest, the incidence of EPS round-ups was found to be positively associated with price-earnings ratios and negatively associated with absolute levels of earnings per share.

Of course, it is probably true that the dollar effect of most EPS round-offs is insignificant, at least in terms of direct effects on capital-asset prices or absolute levels of reported EPS statistics. Nonetheless, if some managers believe that EPS round-offs are important enough to bias, then this behavior is important enough for researchers to investigate. As such, this study has provided additional evidence of the tendency for managers (1) to bias financial statement numbers and (2) to do so in a fashion that is consistent with the manager's self-interest.

VI Suggestions For Future Research

Various avenues for future research are suggested by this study. For example, additional insights into financial-reporting behavior may be gained by extending this study's methodology and approach to quarterly EPS computations. Second, more robust results probably would be obtained if variables more directly associated with managers' incentives to bias EPS round-offs were identified. For example, one might identify companies in which executive compensation is tied directly to reported EPS, and then test whether the incidence of round-off bias for this group differs from a control group. Finally, the following question -- interesting in its own right -- also poses some interesting model-specification issues: is the observed incidence of EPS round-ups due to a general tendency among many managers to bias EPS round-offs on an occasional basis, or is it due primarily to a minority of managers who bias EPS round-offs on a consistent basis?

Footnotes

1. Occasionally, a company will report earnings per share to a tenth of a cent on the face of its income statement. However, such instances are rare and usually confined to smaller firms, not the kind of firms included in this study, i.e., firms on Standard and Poor's COMPUSTAT Primary, Secondary, and Tertiary Annual Industrial Tapes.
2. To eliminate a potential source of misunderstanding, note that this study focuses on the round-off of EPS decimal expansions, as illustrated in the text. Both Carslaw and Thomas focused on the tendency of managers to report approximate, i.e., "round," earnings numbers (e.g., EPS of $8.00 rather than $7.97.) Carslaw and Thomas did not address the round-off of EPS decimal expansions. Another potential source of misunderstanding involves the distinction between the nth-digit in a decimal expansion and the nth-most-left digit in a number. For example, in the ratio [6134 / 13 = 471.8461...], the third digit in the decimal expansion is 6, while the third-most-left digit in the number is 1.
3. Hereafter, unless the context suggests otherwise, the term "earnings per share" is used to refer to either profits or losses per share. When a distinction is to be made, the term "profit per share" or "loss per share" is used.
4. Accounting Principles Board Opinion No. 15 requires public corporations to disclose "the bases on which both primary and fully diluted earnings per share are calculated" (par. 20). In addition, the SEC requires a computational exhibit on earnings per share to be included in most filings, including annual reports on Form 10-K [Kay and Searfoss, 1989, Chapter 20, p 37.]
5. One would expect to obtain an unbiased estimate of the incidence of EPS round-ups by filtering observations on $USABLEOB_{i,t}$. Nonetheless, the use of rounded initial data will cause $ROUNDUP_{i,t}$ to be misclassified in some instances.
6. If observations were filtered only on the basis of $USABLEOB_{i,t} = 1$, N would be 32,305 and ROUNDUP's mean would be .541. If no filter was applied, N would be 35,186 and ROUNDUP's mean would be .538. Under the hypothesis that ROUNDUP = .500, both of these proportions are significant at the .0001 level.
7. Even if all managers rounded off EPS calculations, some might cite "Benford's Law" as a reason why the expected frequency of the third digit in an EPS decimal expansion may not be a uniform 1/10. Benford's Law, recently described in accounting literature by Thomas [1989], holds principally that the observed frequency of first digits of numerical data is not equiprobable, but instead is approximated by a logarithmic probability function. Benford's Law, also known to mathematicians as the "first digit

problem" (see Raima [1976]), is not considered relevant to the research design of this study, if only because the law is primarily relevant to the determination of the first digit of a number, to a lesser extent the second digit, and to remaining digits to a negligible extent. (See McLaughlin and Lundy [1984]).

8. The skewness of the no-P/E-filter distribution is attributed primarily to the fact that a firm's P/E ratio can practically increase without bound as its earnings per share approaches zero--a not uncommon occurrence. Although the P/E filter of 25 is somewhat arbitrary, price-earnings ratios in excess of 25 tend to lack a meaningful economic interpretation, and usually are attributable to a low current earnings rather than to especially favorable future growth prospects.
9. It may seem that one possible source of model misspecification is the failure to control for firm-size effects. However, various diagnostic tests did not indicate a significant association between firm size (as proxied by the natural log of sales) and $ROUNDUP_{i,t}$. For example, in a logit regression of ln $SALES_{i,t}$ (COMPUSTAT Annual Data Item 12) on $ROUNDUP_{i,t}$, the coefficient formed on ln $SALES_{i,t}$ had a t-statistic of .72, which clearly is not significant at conventional levels.

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