

The Stock Market's Under-reaction to Rounding-up in EPS

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ABSTRACT

Reported earnings per share (EPS) are frequently rounded to the nearest cent. The business press and recent academic research provide evidence that firms manipulate earnings so that they can round-up and report one more cent of EPS. This paper examines the stock market's reaction to rounding-up. We find that investors differentiate in their response towards rounding-up firms and non-rounding-up firms at the time of earnings announcements. However, we find that investors' reaction is not complete. The hedge portfolio with a long position in non-rounding-up firms and a short position in rounding-up firms generates statistically significant positive abnormal returns in the subsequent quarter.

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1. Introduction

Accounting standards require that all publicly traded firms report earnings per share (EPS) in their financial statements. Loosely speaking, EPS is computed as the net earnings available to common stockholders divided by the weighted average number of common shares outstanding during the fiscal period¹. Rounding to the nearest cent is required when the calculated EPS is not an integer in cents. For example, a firm with actual EPS of 4.4 cents per share will report EPS of 4 cents per share while a firm with actual EPS of 4.5 cents per share will report EPS of 5 cents per share. This reporting practice thus provides an opportunity for managers to manipulate the numerator upwards by a small amount and use rounding to report an additional cent of EPS, especially in settings where such upward manipulation will assist in meeting behavioral thresholds, such as analysts' forecasts.

Several anecdotal evidences have recently been reported in the business press of managers rounding-up reported earnings per share to meet analysts' forecasts. For example, the 'Heard on the Street' column of the *Wall Street Journal* recently reported that Discount retailer Dollar General "pleased Wall Street by reporting earnings of 17 cents a share for its fiscal first quarter ended April 28 – exactly what securities analysts had projected. Relieved investors, who had seen some other retailers report disappointing earnings, bid the stock up 50 cents on May 9, the day of the report, while the broad market indicators were down" (McGough 2000a). The company actually had earned only 16.575 cents a share, but rounding to the nearest cent helped meet analysts' forecasts. Another company, Black Box, reported net (income) that exactly met analysts' forecasted EPS of 72 cents a share, by rounding-up from the actual EPS of 71.505 cents

¹ The calculation of EPS differs between basic (primary) and diluted (fully diluted) EPS.

a share. Black Box earned more than 14 million in its quarter and if it had earned *just* \$750.63 less, it would have had to report that it had earned 71 cents instead of 72 cents a share (McGough 2000b). These examples highlight the small amount of earnings that managers need to manipulate so that they can round-up earnings to meet analysts' forecasts.

In a recent work, Das and Zhang (2001) provide systematic evidence that managers use their discretion to manipulate earnings upwards so that they can round-up EPS. Specifically they find that firms round-up earnings more frequently than would be expected by mere chance. They provide evidence that such preponderance of rounding-up is neither quarter-specific, year-specific nor industry-specific. They also find that firms with high working capital accruals are more likely to round than firms with low working capital accruals. Their result suggests that managers use working capital accruals to round-up earnings, implying that part of the reported earnings is the result of earnings manipulation for firms that round-up EPS.

It is true that rounding only adds one cent, and hence from an economic standpoint, may seem insignificant. However, an extra cent, under some circumstances, may lead to significant valuation consequences. Numerous anecdotal evidences show that firms falling short of street expectations by one cent are often harshly penalized by investors. Similar systematic evidence is found in Defond and Park (2000) and Skinner and Sloan (2001). Additionally, Das and Zhang (2001) find that in their sample, for 36.1% of the observations, a one-cent increase in basic EPS excluding extraordinary items is equivalent to a percentage increase greater than or equal to 5%. They also find that for 16.6% of their observations, the actual EPS as reported by I/B/E/S is either equal to or less than analysts' forecast by 1 cent. For those firms, rounding-up avoids or can potentially avoid the drastic negative market response to reported EPS falling short of

analysts' forecasts. Such evidence provides support for the economic significance of an extra cent of EPS.

Consider two firms reporting identical EPS numbers, one rounds up its earnings and the other does not. We would expect that the reported earnings of the rounding-up firm to be valued less because the actual earnings is less. For example, suppose there are two firms reporting 4 cents per share. One firm's actual earnings is 3.5 cents per share (it reports 4 cents per share through rounding-up) and the other's is 4.4 cents per share (its earnings is rounded down). The actual earnings of the second firm is higher than the actual earnings of the first firm. Moreover, Das and Zhang (2001) find evidence that part of the earnings is the result of earnings manipulation for firms that round-up earnings. For the above two reasons, *ceteris paribus*, the non-rounding-up firm should have a higher value than the rounding-up firm.

Sloan (1996) finds that investors do not differentiate between the accrual component and the cash flow component of earnings, even though the two components have different persistence levels. His evidence suggests that investors fixate on reported earnings. If investors fixate on reported earnings, the valuation of the two firms in the above example will be identical since they report the same EPS. Thus, fixation on reported earnings will lead to mis-pricing and create arbitrage opportunities.

The primary purpose of this paper is to examine the stock market's reaction to rounding-up. Specifically we examine two issues: (a) do investors respond differently to the same EPS reported by rounding-up firms and non-rounding-up firms? (b) can we identify trading strategies based on knowledge of whether the firm rounds up its earnings?

The remainder of the paper is organized as follows. Section 2 provides a brief description of our data and the sample selection procedure followed by a description of how we identify

rounding-up firms on an ex-post basis. Section 3 provides evidence on the preponderance of rounding-up. Section 4 investigates the market's reaction to rounding up at the time of earnings announcements. Section 5 examines the subsequent abnormal stock returns for rounding-up firms and non-rounding-up firms and identifies a profitable trading strategy. Section 6 concludes the paper.

2. Data and Sample Selection

Our sample is formed by merging the I/B/E/S Summary database with Standard & Poors' Quarterly Compustat (including Industrial, Full Coverage and Research Files). We use quarterly data instead of annual data because we want to maximize the number of observations in our sample². The final sample comprises of all firms for which the following data are available: income before extraordinary items adjusted for common stock equivalents³ (Compustat data item # 10); the number of common shares used to calculate quarterly basic (primary) EPS (Compustat data item # 15); extraordinary items and discontinued operations (Compustat data item # 26); the last available mean consensus earnings forecast before the quarterly earnings announcement⁴, and actual quarterly EPS as reported by IBES. The sample period of this study extends over the fiscal years 1994 through 1998, yielding 64916 firm-quarter observations. The number of observations ranges from 8959 for year 1998 to 16,447 for 1997.

² The main findings of our paper can be replicated using annual data.

³ Prior to adoption of SFAS #128, this data item represents net income after preferred dividend requirements and adjusted for any dollar savings due to conversion of common stock equivalents but before extraordinary items and discontinued operations. After adoption of SFAS #128, this data item is largely set equal to income before extraordinary items available for common stockholders (Compustat data item #25). We investigate the difference between the two data items, for firms with a footnote indicating adoption of SFAS #128. Among the total of 2195 observations, the difference is equal to zero for all except 8 observations.

⁴ Forecasts made on a diluted basis are converted to forecasts made on a primary basis using the IBES adjustment factor.

To identify firms that round-up their EPS, we calculate earnings before extraordinary items per share. Specifically, we divide the quarterly income before extraordinary items adjusted for common stock equivalents (Compustat data item #10) by the number of common shares used to calculate quarterly basic (primary) EPS (Compustat data item #15)⁵. We calculate net income per share by dividing the sum of quarterly income before extraordinary items adjusted for common stock equivalents (Compustat data item #10) and extraordinary items and discontinued operations (Compustat data item #26) by the number of common shares used to calculate quarterly basic (primary) EPS (Compustat data item #15). If a firm reports positive earnings and the digit immediately right of the decimal of the calculated EPS expressed in cents is greater than or equal to 5, then the indicator variable for rounding-up takes on the value of 1, and 0 otherwise. If a firm reports a loss, then, if the digit immediately right of the decimal is less than 5, the indicator variable takes the value of 1, and 0 otherwise. In sum, if the indicator variable takes the value of 1, under commonly used rounding scheme, the firm will report one more cent than otherwise⁶.

3. Abnormal Frequency of Rounding-up

Under the null hypothesis of no upward manipulation of earnings to round-up, we would expect 50% of the sample firms to round-up purely by chance⁷. We use standard Chi-square test

⁵ Prior to SFAS #128, this data item represents the weighted average or actual number of common shares outstanding, adjusted for conversion of common stock equivalents.

⁶ We can also identify rounding-up firms by comparing the calculated EPS with the reported EPS. We find that, after applying the rounding scheme, for both EPS measures, our calculated number is equal to the reported number for 91% of the observations in our sample. Further investigation shows that the differences are largely due to special scenarios. Most importantly, we obtain identical results when we perform our main tests using the sub-sample where the calculated and the reported EPS numbers are identical.

⁷ Following Thomas (1988), an alternative benchmark expectation can be obtained using Benford's law (1938). According to Benford's law, the digit should fall into 0 - 4 range more often than 5 - 9 range. Given that most of the firms in our sample report profits, Benford's law would predict that we see more non-rounding-up firms (with the digit equal to or below 4) than rounding-up firms (with the digit above 4). The use of Benford's (1938) law to derive the expected proportion strengthens our results on the preponderance of rounding-up.

to test the null hypothesis. The null is tested separately for (i) for the total sample, (ii) the sub-sample of firms reporting profits and (iii) the sub-sample of firms reporting losses. These results are presented in Table 1. X refers to the first digit immediately right of the decimal of the calculated EPS expressed in cents. Panel A reports the results when rounding-up is measured using calculated net income per share. We find that, in cases where firms report profits, the proportion is abnormally high (54.4% versus 50%) for firms with X between 5 and 9 (which means those firms get to report one more cent of profits) and the proportion is abnormally low (45.6% versus 50%) for firms with X between 0 and 4 (which means those firms don't get to report one more cent of profits). A Chi-square test of differences in proportion rejects the null that the actual proportion is equal to the expected proportion at the 0.1% level. On the other hand, for firms reporting losses, the proportion is abnormally high (53.8% versus 50%) for firms with X between 0 and 4 (which means those firms get to report one less cent of losses), while the proportion is abnormally low (46.2% versus 50%) for firms with X between 5 and 9. Chi-square test results reject the null that the actual proportion is equal to the expected proportion at the 0.1% significance level. For the full sample, we find that the proportion of rounding-up firms is 54.3%, significantly higher than the expected proportion of 50%. Panel B reports the results when we measure rounding-up using calculated earnings before extraordinary items per share. These results are similar to the results in Panel A. Overall, the proportion of firms rounding-up earnings is 54.3%, significantly (statistically) higher than the expected proportion of 50%. This therefore represents an abnormal pervasiveness of rounding-up of EPS by managers. Our results are consistent with Das and Zhang (2001).⁸

INSERT TABLE 1 ABOUT HERE

⁸ Das & Zhang (2001) provide more extensive evidence on rounding-up.

4. The Stock Markets' Reaction at Earnings Announcements

In this paper, we first investigate the stock market's response towards rounding-up at the time of earnings announcements. We implicitly assume that the investors have knowledge of the amount of earnings and the number of shares used to calculate EPS at the time of earnings announcements. We measure the market's response by the three-day window size-adjusted return centered on the earnings announcement date. To calculate size-adjusted return, we subtract from the raw return the value-weighted return of the size decile to which the firm belongs. Membership in a particular size decile is determined by the market value at the beginning of the calendar year in which the return period begins.

We estimate the market's response towards rounding-up in earnings, by regressing the return variable on the rounding-up indicator variable and two other control variables. One control variable is analysts' forecast errors, which are computed as I/B/E/S reported earnings minus analysts' mean consensus forecasts before earnings announcements. Following DeFond and Park (2000), the other control variable is an indicator variable, which takes on the value of 1 if the forecast error is within 4 cents of analysts' mean consensus forecasts and 0 otherwise⁹. Specifically, we estimate the following regression:

$$Ret3d = a_0 + a_1 * DIFP + a_2 * INDDIF + a_3 * ROUND + Error \quad (1)$$

where *Ret3d* is the three-day size adjusted return centered around the earnings announcement, *DIFP* is the analysts signed forecast error deflated by the fiscal quarter ending price, *INDDIF* is the indicator variable that takes on a value of one if the absolute value of the forecast error is less than 5 and zero otherwise. *ROUND* is the indicator variable, which takes the value of 1 for firms that round-up their earnings and 0 otherwise.

⁹ We obtain similar results when we only control for analysts' forecast errors.

Freeman and Tse (1992) and Das and Lev (1994) find that the price response is nonlinear and more dramatic towards forecast errors of small magnitude than forecast errors of large magnitude. Drawing on their results, we also add an additional independent variable, representing the interaction between *DIFP* and *INDDIF*, to our regression. This interaction term is included to control for the non-linearity between stock returns and forecast errors. The second regression we run is thus specified as follows:

$$Ret3d = b_0 + b_1 * DIFP + b_2 * INDDIF + b_3 * ROUND + b_4 * INTER + Error \quad (2)$$

The parameter estimates of the above two model specifications are reported in Table 2.

INSERT TABLE 2 ABOUT HERE

Not surprisingly, in both regression 1 and 2, the coefficient on the forecast error variable is positive and significant. Consistent with the results in DeFond and Park (2000), we find that the coefficient on *INDDIF* is significantly positive. Consistent with Freeman and Tse (1992), and Das and Lev (1994), we find that, in regression 2, the coefficient on the interaction term is positive and significant, which implies that the market's response is nonlinear, and more dramatic towards forecast errors of small magnitude than forecast errors of large magnitude. In both regressions, we find that the coefficient on *ROUND* is negative and statistically significant, suggesting that at the time of earnings announcement, the stock market reacts negatively to firms that round-up. The evidence suggests that investors can distinguish rounding-up firms from non-rounding-up firms and react negatively to rounding-up firms.¹⁰ This evidence is consistent with the notion that the market is not completely fooled by the inflated EPS of rounding-up firms.

To test for the robustness of our choice of the return measurement period, we calculated the return from one day before the earnings announcement date to the due filing date of 10Q (45

¹⁰ This result is consistent with anecdotal evidence. For example, the company, Black Box lost value even after meeting analysts' expectations through rounding-up (McGough 2000b).

days after the fiscal quarter end). This return interval yielded results similar to our three day return period. Similar results were also obtained when we use earnings before extraordinary items to measure the indicator variable: *ROUND*.

5. Evidence of Investors' Under-reaction

Our findings in the preceding section suggest that investors distinguish between rounding-up from non-rounding up firms. However, the findings do not exclude the possibility that investors under-react or over-react to rounding-up. Hence, we next examine the post-announcement abnormal returns and investigate whether investors can profit from knowledge about the rounding-up activity of the firm. If returns are predictable, we can devise profitable trading strategies based on whether firms' EPS is rounded up or not. To assess the predictive role of 'rounding-up', we follow Fama and French (1992). Specifically, we examine whether returns for the quarter following the announcement of the EPS, can be successfully predicted using knowledge about the rounding-up activity of the firm. In examining the predictability of returns based on rounding-up, we control for known predictors of subsequent period returns such as earnings-to-price (measured using the ratio of earnings per share to fiscal quarter end stock price), beta (measured by estimating the market model on the prior 36 monthly stock return), book-to-market (measured as the log of the ratio of the book value of equity to the market value of equity), and firm size (measured as the natural logarithm of the market value of equity). Our regression specification therefore can be written as follows:

$$QRET = b_0 + b_1 * SIZE + b_2 * LOGBP + b_3 * EP + b_4 * BETA + b_5 * ROUND + Error \quad (2)$$

where *QRET* is the stock return for the return window starting from the second day after current earnings announcement date to the second day after next earnings announcement date; *SIZE* is measured as the market value of equity at the end of the fiscal quarter; *LOGBP* is the logarithm

of the book to price ratio; *EP* is the earnings to price ratio; *BETA* is the beta from the market model and *ROUND* is an indicator variable that takes on a value of one if the firm rounded-up its net income per share and 0 otherwise. The results of estimating the above equation are reported in Table 3.

INSERT TABLE 3 ABOUT HERE

Consistent with prior research, both book-to-market ratio and earnings-to-price ratio are positively and significantly correlated to the subsequent quarter returns. The coefficient on the variable of interest, *ROUND*, is significantly negative. This suggests that, after controlling for size, *E/P*, *B/M* and *Beta*, the rounding-up indicator variable significantly predicts next quarter's return. The slope coefficient shows that the annualized quarterly return of the arbitrage portfolio with a long position in firms that do not round and a short position in firms that do round is about 2.4%, after controlling for earnings-to-price, historical beta, size and book-to-market. The small magnitude of the abnormal return is reasonable because rounding-up only gives one more cent in EPS.

These results are robust to our choice of the return measurement interval. Specifically, we find similar results when the return is calculated from the day after the 10Q filing date to the second day after the next earnings announcement date.

6. Summary

In this paper we examine the stock market's reaction to rounding-up. Overall, our result is consistent with the notion that the stock market under-reacts to rounded-up EPS at the time of the earnings announcement and have false expectations for rounding-up firms. When the rounding-up firms report next quarter's earnings, investors are negatively surprised. This

evidence suggests that an investment strategy based on whether EPS is rounded up, can generate positive abnormal returns.

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Table 1
Frequency of Rounding

	Positive		Negative		Round	
	$0 \leq X^1 < 5$	$5 \leq X$	$0 \leq X < 5$	$5 \leq X$	YES ²	NO
<i>Panel A: Net Income Per Share</i>						
N ³	23684	28228	6958	5968	35264	29652
Actual	45.6	54.4	53.8	46.2	54.3	45.7
Proportion						
Expected	50.0	50.0	50.0	50.0	50.0	50.0
Proportion						
<i>P-value</i>	0.001		0.001		0.001	
<i>Panel B: Earnings before Extraordinary Items Per Share</i>						
N	23896	28313	6841	5783	35237	29679
Actual	45.8	54.2	54.2	45.8	54.3	45.7
Proportion						
Expected	50.0	50.0	50.0	50.0	50.0	50.0
Proportion						
<i>P-value</i>	0.001		0.001		0.001	

Notes:

1. X refers to the first digit immediately right of the decimal of the calculated EPS expressed in cents.
2. “Yes” means that the company rounds up its earnings and “No” means the company does not round up its earnings.
3. N reports the total number of observations, which includes both rounding-up firms and non-rounding-up firms.

Table 2
The Stock Market's Reaction to Earnings Announcements

Earnings Announcement Returns ¹				
$Ret3d = a_0 + a_1 * DIFP + a_2 * INDDIF + a_3 * ROUND + Error (1)$				
	a ₀	a ₁	a ₂	a ₃
Estimate	0.002	0.131	0.002	-0.0013
P-value	0.003	0.0001	0.0007	0.032

$Ret3d = b_0 + b_1 * DIFP + b_2 * INDDIF + b_3 * ROUND + b_4 * INTER + Error (2)$					
	b ₀	b ₁	b ₂	b ₃	b ₄
Estimate	0.002	0.121	0.002	-0.001	3.233
P-value	0.007	0.0001	0.004	0.065	0.0001

Note: The pooled regression is based on 58290 firm-quarter observations.

DEFINITIONS:

DIFP is analysts' forecast error divided by the price at the end of current fiscal quarter.

INDDIF is equal to 1, if the absolute forecast error is less than 5 cents and 0 otherwise.

ROUND represents rounding-up in net income per share.

Ret3d is the three-day size-adjusted return centered on earnings announcement date. The size decile return is the value-weighted return of the size decile to which the observations belongs. Membership in a particular size decile is determined by the market value at the beginning of the calendar year in which the return period begins.

LOGBP is the logged value of book value to the market value. The market value is measured at the end of the fiscal quarter.

EP is earnings to book.

BETA is estimated from a regression of monthly raw returns on the CRSP NYSE/AMEX/ NASDAQ equal weighted monthly returns. The regression is estimated using the 36 months prior to the current fiscal quarter end.

Qret is the raw return on the return window starting from the second day after current earnings announcement date to the second day after next earnings announcement date.

Inter is defined as $DIFP * INDDIF$.

Table 3

Predictability of Sock Market Returns Based on Rounding-up

Next Quarter's Returns ¹						
$Qret = b_0 + b_1*SIZE + b_2*LOGBP + b_3*EP + b_4*BETA + b_5*ROUND + Error$						
	b ₀	b ₁	b ₂	b ₃	b ₄	b ₅
Estimate	0.061	0.0009	0.012	0.0628	-0.006	-0.006
P-value	0.0001	0.221	0.0001	0.012	0.0001	0.007

Note: The pooled regression is based on 34283 observations.

DEFINITIONS:

DIFP is analysts' forecast error divided by the price at the end of current fiscal quarter.

INDDIF is equal to 1, if the absolute forecast error is less than 5 cents and 0 otherwise.

ROUND represents rounding-up in net income per share.

Ret3d is the three-day size-adjusted return centered on earnings announcement date. The size decile return is the value-weighted return of the size decile to which the observations belongs. Membership in a particular size decile is determined by the market value at the beginning of the calendar year in which the return period begins.

LOGBP is the logged value of book value to the market value. The market value is measured at the end of the fiscal quarter.

EP is earnings to book.

BETA is estimated from a regression of monthly raw returns on the CRSP NYSE/AMEX/ NASDAQ equal weighted monthly returns. The regression is estimated using the 36 months prior to the current fiscal quarter end.

Qret is the raw return on the return window starting from the second day after current earnings announcement date to the second day after next earnings announcement date.