2-2021

Examining the phenomenon of rounding in analysts' EPS forecasts: Evidence from Singapore

Clarence GOH
Singapore Management University, clarencegoh@smu.edu.sg

Examining the phenomenon of rounding in analysts' EPS forecasts: evidence from Singapore

Clarence Goh

Singapore Management University, Singapore, Singapore

Abstract

Purpose – Prior studies have documented the phenomenon of rounding of analysts' earnings per share (EPS) forecasts in the USA. From the outset, it is unclear if analysts following Singapore firms also similarly engage in the rounding of their EPS forecasts. This study aims to investigate the extent to which analysts engage in rounding of EPS forecasts of firms listed on the Singapore Exchange.

Design/methodology/approach – The author conducted his analysis on a sample of analyst EPS forecasts of companies listed on the Singapore Stock Exchange, downloaded from the International Brokers Estimate System (I/B/E/S). This sample consists of 24,219 annual EPS forecasts announced from June 2011 to September 2019. These forecasts were made for 285 unique firms by 48 unique analysts.

Findings – The author finds that there is substantial rounding of EPS forecasts, with 9.59% of EPS forecasts examined ending in five- or ten-cent intervals. In supplementary analysis, the author further finds that the level of rounding was comparable across two periods under examination, from 2011 to 2015 and from 2016 to 2019. The author also finds that there was substantial rounding even for forecasts of relatively large magnitudes (i.e. US$1.00 and above).

Originality/value – This study is the first to examine the rounding of analysts' EPS forecasts of Singapore firms. It extends the literature on analyst EPS forecasts and highlights how the phenomenon of rounding of analyst EPS forecasts of US firms extends to Singapore.

Keywords Earnings per share (EPS), Analyst forecasts, Singapore

Paper type Research paper

1. Introduction

Firms whose securities are publicly traded have to disclose earnings per share (EPS) figures, which are computed by dividing profit or loss attributable to ordinary equity holders of the parent entity (the numerator) by the weighted average number of ordinary shares outstanding (the denominator) during the period (IAS 33). Analysts following these firms also report estimates of these EPS ahead of the disclosure of the actual figures. Investors and other recipients of financial information in Singapore often rely on analysts' EPS forecasts as inputs in their own valuations of target firms (Loh and Mian, 2003).

Prior accounting research has documented the phenomenon of rounding in analysts' EPS forecasts, where forecasts frequently end in five- or ten-cent intervals (e.g. Aknono *et al.*, 2019; Herrmann and Thomas, 2005; Dechow and You, 2012). In particular, both Herrmann and Thomas (2005) and Dechow and You (2012), in examining analyst EPS forecasts of US firms, report that forecasts end in five- or ten-cent intervals (e.g. US$0.050 and US$0.100) at a rate much greater than should be expected. Dechow and You (2012) further suggest that the tendency for analysts to round can be influenced by contextual factors, including behavioral incentives. At the same time, Akono *et al.* (2019) suggests that the analysts' rounding behavior may be motivated by management relation incentives.

It is important to understand the extent of rounding of analysts' EPS forecasts of Singapore firms. While analysts following Singapore firms face many of the same behavioral incentives that analysts following US firms do, it is unclear if analysts following Singapore firms will engage in rounding of EPS forecasts to the same extent as their counterparts in the USA, given unique features of analyst forecasts (Black and Carnes, 2006) and the equities market (Yi and Tan, 2009) in Singapore. Research also suggests that cultural factors may lead to these two groups of analysts engaging in rounding behavior to a different extent, particularly given significant differences between the USA and Singapore in the acceptance of rounding (Nguyen *et al.*, 2007) and in the role that rounding can play in relationship cultivation (e.g. Akono *et al.*, 2019; Hung, 2004).

This issue was examined using a sample of 24,219 analyst forecasts of EPS for Singapore firms made from 2011 to 2019, downloaded from the International Brokers Estimate System (I/B/E/S). This study finds evidence of rounding of the EPS forecasts, with 9.59% of forecasts ending in five- or ten-cent intervals. Overall, across the 20 possible digit combinations ending in five- or ten-cent intervals, there was a mean of 100.00 forecasts per digit combination. This compares with an overall mean of 20.85 per digit combination across the full set of 1,000 possible digit combinations (i.e. both round and non-round digit combinations). The results from Benford's law's last-two-digit tests are also consistent with significant rounding in analysts' EPS forecasts. In supplementary analysis, this study finds evidence that the level of rounding was comparable across two periods under examination, from 2011 t0 2015 and from 2016 to 2019. It also finds that there was substantial rounding even for forecasts of relatively large magnitudes (i.e. US$1.00 and above).

This study extend prior research by being the first to examine the phenomenon of rounding of analysts' EPS forecasts in Singapore. Its findings are important because it provides evidence of significant rounding of analysts' EPS forecasts in Singapore. These insights are useful to users of these forecasts, including investors, given prior evidence that the rounding of EPS forecasts may be associated with analyst characteristics such as effort (Choi, 2018), and that investors perceive rounding as a salient feature of analyst forecasts (Athanasakou and Simpson, 2016). To the extent that rounding is more prevalent in Singapore than in the USA because of cultural factors (such as when using rounding to cultivate relationships, Akono *et al.*, 2019; Hung, 2004), this study also provides insights to Singapore investors of the extent of rounding observed in Singapore analysts' EPS forecasts.

The rest of the paper proceeds as follows. Section 2 introduces and examines the phenomenon of rounding in analysts' EPS forecasts. Section 3 discusses the methodology used in this paper to examine the rounding of analysts' EPS forecasts of Singapore firms. Section 4 presents my results, while section 5 presents supplementary analysis. Finally, section 6 concludes.

2. Rounding in analysts' EPS forecasts

IAS 33 requires that an entity whose securities are publicly traded (or that is in process of public issuance) must present, on the face of the statement of comprehensive income, its basic EPS. Basic EPS is computed by dividing profit or loss attributable to ordinary equity holders of the parent entity (the numerator) by the weighted average number of ordinary shares outstanding (the denominator) during the period (IAS 33). Analysts are an important set of intermediary who receive and process financial information for investors. One important way in which they perform the intermediary role is by making forecasts of EPS (Schipper, 1991). Consistent with the notion that analysts play an intermediary role, research has documented strong associations between analysts' EPS forecasts and stock returns (e.g. Athanassakos and Kalimipalli, 2003) and has examined analyst EPS forecasts as proxies for expected earnings (e.g. Brown, 1993).

Prior research has documented various characteristics of analysts' EPS forecasts, including the rounding of EPS forecasts, where forecast values frequently end in five- or ten-cent intervals (e.g. Dechow and You, 2012; Herrmann and Thomas, 2005). For example, Herrmann and Thomas (2005) document that analysts' EPS forecasts for a sample of US firms ended in nickel intervals (i.e. five-cent intervals) at a rate that is 2.75 times greater than expected. Similarly, Dechow and You (2012) report that for their sample of US firms, about 34% of analyst EPS forecasts are rounded when the forecasts are less than US$1, 49% of forecasts are rounded when they are between US$1 and US$10 and 60% of forecasts are rounded when they are above US$10.

This observation of rounding in analysts' EPS forecasts is related to the phenomenon of heaping, which is often found in discrete quantitative data provided by subject reports or observer assessments (Herrmann and Thomas, 2005). Psychology research suggests that heaping reflects cognitive processes where individuals may choose culturally defined "round" or "even" numbers as responses when providing estimates. This tendency has been termed "digit preference" and is observed to occur when heaped values correspond to a limited set of terminal digits. Heaping has been observed in a wide variety of contexts, including in estimates of personal network size (Roberts and Brewer, 2001), job tenure (Ureta, 1992), current weight (Rowland, 1990), smoking (Brown *et al.*, 1998), blood pressure (Wen *et al.*, 1993) and ultrasound measures (Wright and Bray, 2003).

In their study, Dechow and You (2012) examine analysts' motives for rounding EPS forecasts and show that the presence of different types of behavioral incentives can predict the likelihood of analysts engaging in rounding. First, they suggest that analysts will put in more effort into providing more accurate and precise EPS forecasts when there is monetary benefit to them in doing so. For example, part of an analysts' job is to provide research to clients that will generate interest in a stock and encourage trading through the brokerage division (Jackson, 2005). To the extent that more trading activity leads to more brokerage fees for the brokerage division and more bonus compensation for the analyst (Groysberg *et al.*, 2011), it is more likely that analysts will engage in rounding (and hence expand less effort) when estimating the EPS of firms that generate less brokerage fees while focusing on obtaining more precise estimates for firms that generate more brokerage fees. Second, research suggests that corporate financing is an important source of revenue for investment banks, which many analysts work for (Bradshaw *et al.*, 2006). In this respect, analysts are likely to have an incentive to help their employers (i.e. investment banks) to compete for and attract underwriting business by exerting more effort in making precise EPS forecasts for firms that are seeking to raise more external financing. By contrast, they are likely to reduce their effort and engage in rounding when forecasting EPS for firms that are not actively raising external financing. Third, making forecasts for larger and more complex firms will necessarily require the analyst to acquire more information and to expand more effort in understanding that information. All else equal, this would lead to a greater propensity for analysts to round when making forecasts for more complex (versus less complex) firms (Dechow and You, 2012). Overall, this discussion suggests that contextual factors can influence the extent to which analysts engage in rounding of EPS forecasts.

The research discussed above focuses on analysts' EPS forecast in the specific geographic context of the USA. In Asia and Singapore, analysts' EPS forecasts remain important and form an important part input in the valuation of firms by market participants (Loh and Mian 2003; Covrig and Low, 2005). In Singapore, research has also documented that analysts' EPS forecasts are similarly subjected to behavioral biases, including the tendency to issue forecasts that are systematically optimistic due to heightened economic uncertainty (Loh and Mian, 2003). To the extent that analysts following firms in Singapore are subject to similar incentives and behavioral biases as those in the USA, we would expect

the extent of rounding of analysts' EPS forecasts of Singapore firms to be similar to those in the USA. At the same time, however, management research suggests that there are cultural differences in the factors that motivate employees across different geographic locations, with different motivational factors influencing employees differently across geographic locations (e.g. Nicolopoulou *et al.*, 2007; Herbig and Genestre, 1997). Further, Spector and Wimalasiri (1986) examined the level of job satisfaction of US and Singapore employees and found significant differences between the structure of job satisfaction among Singapore and US employees.

Research also suggests that cultural factors may lead to analysts in the USA and Singapore engaging in rounding behavior to a different extent. For example, in the marketing context, Nguyen *et al.* (2007) suggest that consumers in high context, mainly non-western societies (including Singapore), may be more willing to accept retail prices that are rounded than their counterparts in low context, mainly western societies, because they are less susceptible to the illusion of cheapness or gain created by non-rounded prices (which, for example, end with the non-rounded digit 9) [1]. Applied to the analyst forecasting context, this suggests that analysts in Singapore may be more willing to provide round forecasts than their counterparts in the USA because recipients of their forecasts, being from a high-context society, may be more receptive to rounded forecasts. At the same time, in examining a sample of US firms, Akono *et al.* (2019) document that the rounding of analysts' EPS forecasts could be motivated by the incentive to cultivate and maintain good relations with managers of the firms that they follow. To the extent that characteristics of Asian culture, including favor and relational harmony, play a role in relationship cultivation in the business context in Asian societies such as Singapore (Hung, 2004), it is possible that the role that rounding plays in analysts' efforts to cultivate and maintain good relationships with managers in Singapore is more pronounced than observed in the USA.

To the extent that motivational and cultural factors influence analysts in Singapore and the USA differently, and that these two sets of analysts respond differently to incentives, the factors that Dechow and You (2012) suggest can influence the extent of rounding of US analysts' EPS forecasts may not influence Singapore analysts in the same way. Accordingly, the foregoing discussion suggests that the extent of rounding in analysts' EPS forecasts of Singapore firms is unclear. This leads to the following research question:

RQ. To what extent do analysts engage in rounding of EPS forecasts of firms listed on the Singapore Exchange?

3. Methodology
This study conducted an analysis on a sample of analyst EPS forecasts of companies listed on the Singapore Stock Exchange, downloaded from the I/B/E/S. This sample consists of 24,219 annual EPS forecasts announced from June 2011 to September 2019. These forecasts were made for 285 unique firms by 48 unique analysts. Overall, the values of these EPS forecasts ranged from –US$0.80 to US$1,490.72 [2].

From the sample, the digits in the decimal places of each EPS forecast (i.e. digits after the dollar values) were extracted. Overall, 20,852 (86.10%) of EPS forecasts were made to three decimal places or fewer, while 3,367 (13.90%) were made to four decimal places. To examine the extent of rounding in EPS forecasts, this analysis focuses on forecasts made to three decimal places or fewer by counting the number of forecasts corresponding to each specific three-digit combination – ranging from 0.000 to 0.999 – possible in the decimal places. In particular, a forecast is considered to have been rounded if it ends in five- or ten-cent values (e.g. US$0.050 or US$0.100), consistent with prior studies (e.g. Herrmann and Thomas, 2005) [3].

4. Results

In examining the number of EPS forecasts corresponding to each specific three-digit decimal combination, there is a visible spike in the number of forecasts ending in five-cent values (i.e. US$0.050), consistent with the phenomenon of rounding by analysts in making EPS forecasts [4]. Across the 1,000 possible three-digit decimal combinations (i.e. from US$0.000 to US$0.999), there was a mean (standard deviation) of 20.85 (37.26) forecasts per decimal combination.

Table 1 presents a detailed breakdown of the EPS forecast count by decimal combinations ending in five- or ten-cent values (i.e. rounded forecasts). There were a total of 2,000 rounded forecasts, corresponding to 9.59% of forecasts examined. Across the 20 possible decimal combinations ending in five- or ten-cent intervals, there was a mean (standard deviation) of 100.00 (87.58) forecasts per decimal combination. Further, it appears that rounding is more prevalent across the smaller decimal combination, with a mean (standard deviation) count of 203.33 (102.03) for decimal combinations from US$0.000 to US$0.250 and a mean (standard deviation) count of 55.71 (12.94) for decimal combinations from US$0.300 to US$0.950. Overall, the higher number of forecasts ending in five- or ten-cent intervals relative to other interval values are consistent with substantial rounding in analyst EPS forecasts in my sample.

4.1 Benford's law's last-two-digit test

Benford's law-based tests are a form of digital analysis technique and have been used to detect anomalies in accounting data, including in the areas of insurance claims (Lu and Boritz, 2005), employee expense reports and credit card fraud (Aris et al., 2017). Aris et al. (2017) suggest that Benford's law's last-two-digit test can be performed to detect rounding in numbers. In particular, Benford's law's last-two-digit tests compares the actual frequencies with which a number's last-two-digit combinations appear in a dataset with their respective frequencies predicted by Benford's law. Accordingly, this study applied Benford's law's last-two-digit test on the sample of analyst EPS forecasts. Figure 1 presents the results of the test.

EPS forecast decimal combination	Number of forecasts
0.000	120
0.050	396
0.100	213
0.150	152
0.200	208
0.250	131
0.300	63
0.350	83
0.400	45
0.450	53
0.500	57
0.550	54
0.600	68
0.650	57
0.700	51
0.750	29
0.800	58
0.850	44
0.900	69
0.950	49
Total	*2,000*

Table 1.
Rounded analyst
EPS forecast
values – overall
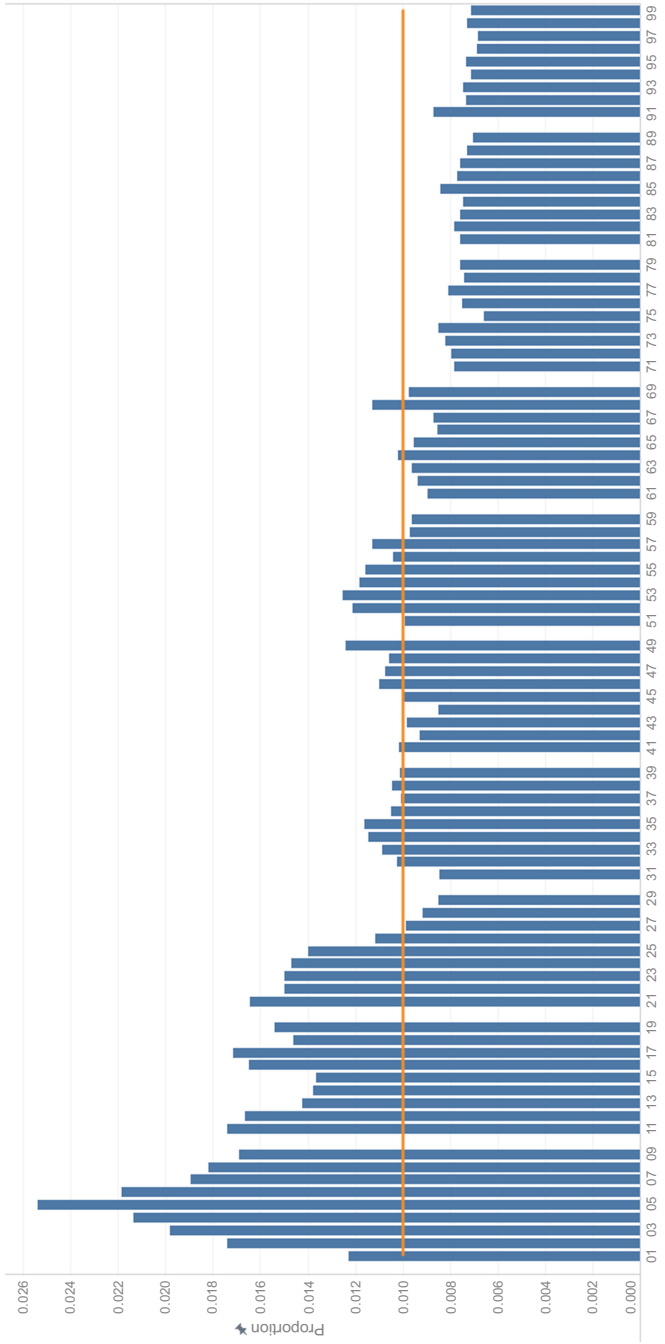
The bars in the figure represent the proportion with which possible last-two-digit combinations appear in the analysts' forecasts, while the horizontal line in the figure represents the expected proportion with which the last-two-digit combinations are expected to appear. In observing the figure, it can be noted that there is substantial deviation between the actual and expected proportions with which last-two-digit combinations appear in the analysts' EPS forecasts, consistent with significant rounding in analysts' EPS forecasts.

5. Supplementary analysis

5.1 Rounding of EPS forecasts across time

Research suggests that rounding in analysts EPS forecasts can be influenced by factors that change over time, such as the level of competition among analysts (Lys and Soo, 1995) and the level of precision of information available to analysts (Zhou, 2010). To examine whether the tendency of analysts in our sample to produce rounded EPS forecasts changes over time, the sample was split into two sub-samples, with sub-sample 1 (S1) containing forecasts announced between 2011 and sub-sample 2 (S2) containing forecasts announced between 2016 and 2019. There were a total of 8,271 (12,581) EPS forecasts in S1 (S2) [5].

Across the 1,000 possible three-digit decimal combinations, there was a mean (standard deviation) of 8.27 (14.88) forecasts per decimal combination in S1. There were a total of 865 rounded forecasts, corresponding to 10.46% of forecasts examined in S1. Across the 20 possible decimal combinations ending in five- or ten-cent values, there was a mean (standard deviation) of 43.25 (40.22) forecasts per decimal combination.

Across the 1,000 possible three-digit decimal combinations, there was a mean (standard deviation) of 12.58 (23.08) forecasts per decimal combination in S2. There were a total of 1,135 rounded forecasts, corresponding to 9.02% of forecasts examined in S2. Across the 20 possible decimal combinations ending in five- or ten-cent values, there was a mean (standard deviation) of 56.75 (48.72) forecasts per decimal combination. Overall, the above analysis suggests that there was substantial rounding in analyst EPS forecasts both across the time period from 2011 to 2015 and from 2016 to 2019.

5.2 Rounding of large magnitude EPS forecasts

There is tension as to whether or not the rounding of analyst EPS forecasts will be more prevalent when EPS magnitudes are relatively large. On the one hand, Thomas (1989) suggests that analysts are less likely to round when forecast magnitude is large because the rounding of EPS with relatively large magnitudes may be perceived as being "too obvious and less credible." In addition, Das and Zhang (2003) further suggest that the propensity to round-up EPS figures is negatively related to the magnitude of the reported EPS because "rounding-up means less to firms who typically report large EPS numbers than to firms who typically report small EPS numbers."

On the other hand, psychology research (e.g. Zhang and Schwarz, 2013) suggests that rounding will be more prevalent when fine-grained distinctions are less relevant. To the extent that precise EPS forecasts are less relevant to investors when the magnitudes of such forecasts are large rather than small – because, e.g. rounding from 2.5 to 3 cents represents a 20% increase, while rounding from 51.5 to 52 cents represents only a 1% increase – it is possible that analysts will have a higher tendency to round EPS forecasts of large magnitudes (versus small magnitudes). In addition, Dechow and You (2012) suggest that, other things being equal, it is more difficult and effortful for an analyst to make precise forecasts of EPS values that are of larger magnitude than of smaller magnitudes. By way of example, they highlight that when earnings equal US$1,543 and the number of shares is 100, then EPS is US$15.43. However, if the number of shares outstanding increases to 10,000, then

EPS is 0.15. Although both EPS forecasts are accurate to two decimal places, the first forecast requires the analyst to forecast the total value of earnings to be US$1,543, while the second forecast only requires the analyst to forecast the total value of earnings to be around US$1,500. To the extent that it is more difficult and effortful for the analyst to forecast the total value of earnings more precisely (as in the first forecast which has a larger magnitude), they are more likely to engage in rounding.

This study examined the extent of rounding of EPS forecasts of relatively large magnitudes by analyzing the 3,304 forecasts in my sample that have magnitudes of more than US$1.00. Across the 1,000 possible three-digit decimal combinations, there was a mean (standard deviation) of 3.30 (5.91) forecasts per decimal combination. Table 2 presents a detailed breakdown of the EPS forecast count by decimal combinations ending in five- or ten-cent values (i.e. rounded forecasts). There were a total of 478 rounded forecasts, corresponding to 14.47% of forecasts examined. Across the 20 possible decimal combinations ending in five- or ten-cent values, there was a mean (standard deviation) of 23.90 (9.54) forecasts per decimal combination. Overall, these findings are consistent with substantial rounding in analyst EPS forecasts of magnitudes larger than US$1.00 in the sample.

6. Conclusion

Prior studies have documented the phenomenon of rounding of analysts' EPS forecasts in the USA. From the outset, it is unclear if analysts following Singapore firms also similarly engage in the rounding of their EPS forecasts. This study examined a sample of analyst EPS forecasts of firms listed on the Singapore Exchange and finds that there is substantial rounding of EPS forecasts, with 9.59% of EPS forecasts examined ending in five- or ten-cent intervals. In supplementary analysis, it further finds that the level of rounding was comparable across two periods under examination, from 2011 to 2015 and from 2016 to 2019. It also finds that there was substantial rounding even for forecasts of relatively large magnitudes (i.e. US$1.00 and above).

EPS forecast decimal combination	Number of forecasts
0.000	36
0.050	27
0.100	47
0.150	17
0.200	28
0.250	11
0.300	19
0.350	9
0.400	20
0.450	20
0.500	21
0.550	17
0.600	30
0.650	15
0.700	26
0.750	15
0.800	38
0.850	23
0.900	32
0.950	27
Total	*478*

Table 2.
Rounded analyst EPS forecast values → US$1.00

This study is the first to examine the rounding of analysts' EPS forecasts of Singapore firms. It extends the literature on analyst EPS forecasts and highlights how the phenomenon of rounding of analyst EPS forecasts of US firms extends to Singapore. Given that round EPS forecasts are less accurate than non-round EPS forecasts (Herrmann and Thomas, 2005), these findings are important to users of analyst EPS forecasts. In particular, they are informative because they provide insights into the extent of rounding of analysts' EPS forecasts of Singapore firms. While this study focuses on examining the extent of rounding of analysts' EPS forecasts of Singapore firms, it does not investigate the specific reasons or circumstances under which rounding is more likely to occur. Further studies could extend this stream of research by examining why and how analysts engage in rounding.

Notes

1. The literature suggests that low-context societies attach more meaning to the message itself: what is said is what is meant. By contrast, communication in high-context cultures requires much more attention to "reading" the counterparts, i.e. understanding what they really mean and care about through implicit, non-verbal cues. In high-context cultures, relationships are more important, as meaning in communication is internalized in the person.

2. Supplementary Table 1 presents a summary of the magnitudes of EPS forecasts in the sample. The table can be accessed here: https://drive.google.com/file/d/1jKJUro1TDRyeedh2uI4ObVWvM5zLm z6O/view?usp=sharing

3. Prior research suggests that it is not common for analysts to report EPS forecasts to four decimal places. Consistent with this, this study finds that only 13.90% of the forecasts in the sample were reported to four decimal places. Of these, 81.64% had forecast magnitudes of US$0.15 or smaller. Further, as noted by Herrmann and Thomas (2005), not all forecasts reported in five- or ten-cent intervals are necessarily rounded. It is possible that analysts making forecasts at five- or ten-cent intervals expect EPS to exactly equal these intervals. To the extent that this occurs, it would reduce the power of the tests conducted in the analysis.

4. Supplementary Figure 1 presents a partial representation of the number of EPS forecasts corresponding to each specific three-digit decimal combination. The figure can be accessed here: https://drive.google.com/file/d/1jKJUro1TDRyeedh2uI4ObVWvM5zLmz6O/view?usp=sharing

5. Supplementary Table 2 presents a detailed breakdown of the EPS forecast count by decimal combinations ending in five- or ten-cent values (i.e. rounded forecasts). Panel A (B) presents the breakdown in S1 (S2). The table can be accessed here: https://drive.google.com/file/d/ 1jKJUro1TDRyeedh2uI4ObVWvM5zLmz6O/view?usp=sharing

References

Akono, H., Karim, K. and Nwaeze, E. (2019), "Analyst rounding of EPS forecasts and stock recommendations", *Advances in Accounting*, Vol. 44, pp. 68-80, doi: 10.1016/j.adiac.2018.10.002.

Aris, N.A., Othman, R., Bukhori, M.A.M., Arif, S.M.M. and Malek, M.A.A. (2017), "Detecting accounting anomalies using Benford's law: evidence from the Malaysian public sector", *Management and Accounting Review*, Vol. 16 No. 2, pp. 73-100, doi: 10.24191/mar.v16i2.666.

Athanasakou, V. and Simpson, A. (2016), "Investor attention to rounding as a salient forecast feature", *International Journal of Forecasting*, Vol. 32 No. 4, pp. 1212-1233, doi: 10.1016/j.ijforecast.2016. 02.011.

Athanassakos, G. and Kalimipalli, M. (2003), "Analyst forecast dispersion and future stock return volatility", *Quarterly Journal of Business and Economics*, Vol. 42 No. 1, pp. 57-78.

Black, E.L. and Carnes, T.A. (2006), "Analysts' forecasts in Asian-Pacific markets: the relationship among macroeconomic factors, accounting systems, bias and accuracy", *Journal of International Financial Management and Accounting*, Vol. 17 No. 3, pp. 208-227, doi: 10.1111/ j.1467-646X.2006.00127.x.

Bradshaw, M.T., Richardson, S.A. and Sloan, R.G. (2006), "The relation between corporate financing activities, analysts' forecasts and stock returns", *Journal of Accounting and Economics*, Vol. 42, pp. 53-85, doi: 10.1016/j.jacceco.2006.03.004.

Brown, L.D. (1993), "Earnings forecasting research: its implications for capital markets research", *International Journal of Forecasting*, Vol. 9 No. 3, pp. 295-320, doi: 10.1016/0169-2070(93)90023-G.

Brown, L.D., Burgess, E.S., Sales, S.D., Whiteley, J.A., Evans, D.M. and Miller, I.W. (1998), "Reliability and validity of a smoking timeline follow-back interview", *Psychology of Addictive Behaviors*, Vol. 12, pp. 101-112, doi: 10.1037/0893-164X.12.2.101.

Choi, H.M. (2018), "Short selling and the rounding of analysts' forecasts", *Finance Research Letters*, Vol. 25, pp. 47-54, doi: 10.1016/j.frl.2017.10.001.

Covrig, V. and Low, B.S. (2005), "The relevance of analysts' earnings forecasts in Japan", *Journal of Business Finance and Accounting*, Vol. 32 No. 7, pp. 1437-1463, doi: 10.1111/j.0306-686X.2005.00635.x.

Das, S. and Zhang, H. (2003), "Rounding-up in reported EPS, behavioral thresholds, and earnings management", *Journal of Accounting and Economics*, Vol. 35 No. 1, pp. 31-50, doi: 10.1016/S0165-4101(02)00096-4.

Dechow, P.M. and You, H. (2012), "Analysts' motives for rounding EPS forecasts", *The Accounting Review*, Vol. 87 No. 6, pp. 1939-1966, doi: 10.2308/accr-50226.

Groysberg, B., Healy, P.M. and Maber, D.A. (2011), "What drives sell-side analyst compensation at high-status investment banks?", *Journal of Accounting Research*, Vol. 49 No. 4, pp. 969-1000, doi: 10.1111/j.1475-679X.2011.00417.x.

Herbig, P. and Genestre, A. (1997), "International motivational differences", *Management Decision*, Vol. 35 No. 7, pp. 562-567, doi: 10.1108/00251749710170547.

Herrmann, D. and Thomas, W.B. (2005), "Rounding of analyst forecasts", *The Accounting Review*, Vol. 80 No. 3, pp. 805-823, doi: 10.2308/accr.2005.80.3.805.

Hung, C.J. (2004), "Cultural influence on relationship cultivation strategies: multinational companies in China", *Journal of Communication Management*, Vol. 8 No. 3, pp. 264-281.

Jackson, A.R. (2005), "Trade generation, reputation, and sell-side analysts", *Journal of Finance*, Vol. 60 No. 2, pp. 673-717, doi: 10.1111/j.1540-6261.2005.00743.x.

Loh, R.K. and Mian, M. (2003), "The quality of analysts' earnings forecasts during the Asian crisis: evidence from Singapore", *Journal of Business Finance and Accounting*, Vol. 30 No. 5, pp. 749-770, doi: 10.1111/1468-5957.05443.

Lu, F. and Boritz, J.E. (2005), "Detecting fraud in health insurance data: learning to model incomplete Benford's law distributions", *European Conference on Machine Learning*, Springer, Berlin, Heidelberg.

Lys, T. and Soo, L.G. (1995), "Analysts' forecast precision as a response to competition", *Journal of Accounting, Auditing and Finance*, Vol. 10 No. 4, pp. 751-765, doi: 10.1177/0148558X9501000404.

Nguyen, A., Heeler, R.M. and Taran, Z. (2007), "High-low context cultures and price-ending practices", *Journal of Product and Brand Management*, Vol. 16 No. 3, pp. 206-214, doi: 10.1108/10610420710751582.

Nicolopoulou, K., Karatas-Ozkan, M., Tatli, A., Forstenlechner, I. and Lettice, F. (2007), "Cultural differences in motivating global knowledge workers", *Equal Opportunities International*, Vol. 26 No. 8, pp. 823-833, doi: 10.1108/02610150710836154.

Roberts, J. and Brewer, D. (2001), "Measures and tests of heaping in discrete quantitative distributions", *Journal of Applied Statistics*, Vol. 28, pp. 887-896, doi: 10.1080/02664760120074960.

Rowland, M.L. (1990), "Self-reported weight and height", *American Journal of Clinical Nutrition*, Vol. 52, pp. 1125-1133, doi: 10.1093/ajcn/52.6.1125.

Schipper, K. (1991), "Analysts' forecasts", *Accounting Horizons*, Vol. 5 No. 4, pp. 105-121.

Spector, P.E. and Wimalasiri, J. (1986), "A cross-cultural comparison of job satisfaction dimensions in the United States and Singapore", *International Review of Applied Psychology*, Vol. 35 No. 2, pp. 147-158, doi: 10.1111/j.1464-0597.1986.tb00909.x.

Thomas, J.K. (1989), "Unusual patterns in reported earnings", *The Accounting Review*, Vol. 64 No. 4, pp. 773-787.

Ureta, M. (1992), "The importance of lifetime jobs in the U.S. economy, revisited", *American Economic Review*, Vol. 82, pp. 322-335.

Wen, S.W., Kramer, M.S., Hoey, J., Hanley, J.A. and Usher, R.H. (1993), "Terminal digit preference, random error, and bias in routine clinical measurement of blood pressure", *Journal of Clinical Epidemiology*, Vol. 46, pp. 1187-1193, doi: 10.1016/0895-4356(93)90118-K.

Wright, D.E. and Bray, I. (2003), "A mixture model for rounded data", *Journal of the Royal Statistical Society*, Vol. 52, pp. 3-13, doi: 10.1111/1467-9884.00338.

Yi, Z. and Tan, S.L. (2009), "An empirical analysis of stock market integration: comparison study of Singapore and Malaysia", *Singapore Economic Review*, Vol. 54 No. 2, pp. 217-232.

Zhang, Y.C. and Schwarz, N. (2013), "The power of precise numbers: a conversational logic analysis", *Journal of Experimental Social Psychology*, Vol. 49 No. 5, pp. 944-946, doi: 10.1016/j.jesp.2013.04.002.

Zhou, L. (2010), "Nickels not pennies: granularity in analysts' earnings per share forecasts and forecast revisions", *Journal of Accounting, Auditing and Finance*, Vol. 25 No. 2, pp. 201-233, doi: 10.1177/0148558X1002500203.

Further reading

International Accounting Standards (IAS) 33 (2013), *IAS Plus*, available at: https://www.iasplus.com/en/standards/ias/ias33 (accessed 23 April 2020).

Corresponding author

Clarence Goh can be contacted at: clarencegoh@smu.edu.sg