A Digital Analysis Of The Reported Earnings Of Asian Firms

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Abstract

Prior research (Carslaw, 1988; Thomas, 1989) has noted unusual patterns in the frequency of occurrence of certain digits contained in reported earnings. Employing digital analysis, studies have found that managers in the U.S. and Australia may round reported earnings numbers to achieve income-smoothing objectives. This study extends prior literature by examining whether reported earnings of firms from six Asian countries: South Korea, Malaysia, Philippines, Singapore, Thailand and China follow similar patterns.

Introduction

There are two competing theories as to why managers are motivated to round earnings. Watts and Zimmerman (1986) suggest that management behaviors are affected by contractual parameters. An example would be if key contractual numbers in the debt covenants or compensation contracts were specified in round earnings numbers, thus setting target parameters for managers and small deviation from those rounded numbers can result in a large cash flow effect (Thomas, 1989). Managers might also be motivated to round earnings number because of their perceptions of how stock is valued, and their beliefs that small changes in reported earnings might have potentially large effects on firm value.

Also, prior studies in both psychology as well as business literature have indicated the existence of the "pricing phenomenon" in marketing. This research has pointed to the human tendency to round up or down the number when the reported numbers is near the human cognitive reference point (Gabor and Granger, 1966; Carslaw, 1988). As a result, small changes in reported earnings near user reference points may have disproportionately large effects on perceived firm value, since humans use numbers that are factors of ten as yardsticks in their perception and judgment of other numbers (Garbor and Granger, 1966).

Prior studies by Carslaw (1988) and Thomas (1989) have empirically documented that rounding of numbers or unusual patterns do exist in the reported earnings of Australian as well as U.S. firms. However, no empirical evidence has been shown thus far that the use of this earnings management technique is widespread in any other countries or if similar unusual patterns exist in reported earnings of companies in other countries.

Recent evidence from the earnings management literature documents that earnings management is an international issue. For example, Aharony, Lee and Wong (2000) report evidence suggesting that the Chinese IPO firms engage in earnings management to make their share more marketable to investors, especially foreign investors. Evidence from Australia and U.K. also suggests that certain class of larger publicly traded Australian companies use extraordinary items as income-smoothing instrument (Craig and Walsh, 1989) and that there is a positive association between income smoothing behavior and management share options among British companies (Beattie et al, 1994).

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This study extends prior research in two ways: (1) we provide evidence on the usefulness of digital analysis as a

tool to detect abnormal earnings patterns when earnings are produced by firms from various Asian countries with management cultures that are different from the U.S., (2) we add to the existing line of literature that uses digital analysis as a tool in investigating unusual patterns in earnings numbers with results from six different countries in the Asian region.

Prior Research

One of the tools used by auditor to detect possible earnings manipulation is digital analysis. Digital analysis is a method of analyzing the patterns of digits in a sample of numbers to determine if the sample is similar to a population of numbers. The use of digital analysis is based on the argument that human tampering of numbers inadvertently leaves the distribution of digits in the numbers different from the expected distribution. Digital analysis originates from the research by Frank Benford in the 1920s. Benford postulated that the first digit in a large population of transactions will most often be a one. Less frequently, the first digit will be a two; even less frequently it will be a three. Benford calculated the frequency of occurrence of each numeral appearing as the first digit in a variety of data and found that it decreased inversely with its value. Given Benford's Law, we would expect that valid, unaltered data would follow certain predicted frequencies. An analysis of the frequency distribution of the first or second digits can detect abnormal patterns in the data and may identify possible manipulations of numbers.

Several prior studies have documented unusual patterns in reported earnings using the digital analysis technique. Carslaw (1988) documented that New Zealand firms round up reported earnings when they are just below reference points denoted by $N*10^K$. For example, reported earnings of $1,900,000 may be perceived as being much lower than $2,000,000. Therefore firms round up the earnings from just below the reference point $1,900,000 (having a nine in the second-to-the left-most digit) to just above the reference point $2,000,000 (with a zero in the second-to-the-left most digit). Specifically, there are more zeros and fewer nines than would be expected by chance in the second-from-left-most digit.

Thomas (1989) extended Carslaw's study by examining earnings of United States firms using digital analysis. Specifically, he examined if unusual patterns existed for: (1) firms that report positive earnings, (2) firms that have positive (negative) earnings change, (3) quarterly earnings, and (4) earnings per share data. His results showed that, on average, managers of U.S. firms round positive earnings numbers in a similar pattern as managers of the New Zealand firms as reported by Carslaw. Evidence of rounding can be observed for total earnings as well as the EPS.

Research Method

Our sample firms are selected from the *Compustat Global Vantage* database. The countries included in our study include: South Korea, Malaysia, Philippines, Singapore Thailand and China. Firms in our sample were listed on the largest stock exchange of each of these six countries during the four-year period 1995-1998. All six countries are considered as developing countries in terms of their national economies and their capital markets are relatively small in volume and have less efficiency as compared with developed countries. Table 1 provides a summary of the countries of the 878 firms in our sample. Missing data for some firms in some years resulted in a total of 3,382 observations of reported net income being examined.

Data Analysis And Results

The frequency of occurrence of each possible first and second digit in the reported net incomes of the sample was computed. For example, a reported net income of 4,320,000 baht would indicate a first digit of four and a second digit of three. The computed frequencies for the sample were then compared to the frequencies that would be expected under Benford's Law. Table 2 provides the results.

Table 1
Sample Firms by Country

Country	# of companies

China	49
Malaysia	89
Philippines	90
Singapore	187
South Korea	240
Thailand	223
Total	878

Table 2 makes clear there are no significant differences between the observed and expected frequencies of the first digits in our sample. Although the sample has more nines and fewer ones and twos than would be expected, the differences are not statistically significant. No inference of significant first digit anomalies can be drawn from the results in Table 2.

Table 2
First And Second Digit Frequencies - Observed Vs. Expected

Panel A: First Digit Frequencies:

First Digit	Observed Frequency	Expected Frequency	Difference
1	.2921	.3010	- .0089
2	.1635	.1761	- .0126
3	.1200	.1249	- .0049
4	.1026	.0969	.0057
5	.0836	.0791	.0045
6	.0742	.0669	.0073
7	.0620	.0579	.0041
8	.0514	.0511	.0003
9	.0502	.0457	.0045

Panel B: Second Digit Frequencies:

Second Digit	Observed Frequency	Expected Frequency	Difference
0	.1348	.1196	.0152*
1	.1096	.1138	-.0042
2	.1091	.1088	.0003
3	.1067	.1043	.0024
4	.0884	.1003	.0119*
5	.1061	.0966	.0095*
6	.0875	.0933	-.0058
7	.0759	.0903	- .0144*
8	.0845	.0875	-0030
9	.0969	.0850	.0119*

*difference significant at .05 level

However, analysis of the *second* digit of reported net income revealed several statistically significant differences. As Panel B of Table 2 makes clear, both zeros and nines occurred more frequently than would be expected, while there were fewer than expected fours and sevens. Also, the frequency of occurrence of fives was significantly greater than would be expected under Benford's Law.

Thomas's (1989) theorized that the motivations for rounding and the resulting patterns in reported income would differ between profitable and unprofitable firms. To examine this issue, the sample was divided into positive and negative income subgroups in order to provide additional insight into the nature of these differences. The results of this more detailed analysis are presented in Table 3.

As Table 3 indicates, the frequency distributions are markedly different for the two groups of firms. Firms reporting negative net income have significantly more nines in the second digit than expected. In addition, there were fewer sevens observed in this group than expected. Although the frequency of occurrence of zeros was also less than expected, the difference was not statistically significant.

Table 3
Second Digit Frequencies - Profitable & Unprofitable Firms

Panel A: Profitable Firms:

Second Digit	Observed Frequency	Expected Frequency	Difference
0	.1446	.1196	.0250*
1	.1073	.1138	- 0065
2	.1089	.1088	.0001
3	.1037	.1043	- 0006
4	.0897	.1003	-.0106
5	.1101	.0966	.0135*
6	.0837	.0933	-.0096
7	.0785	.0903	-.0118*
8	.0853	.0875	-.0022
9	.0877	.0850	.0027

Panel B: Unprofitable Firms:

Second Digit	Observed Frequency	Expected Frequency	Difference
0	.1072	.1196	-.0124
1	.1162	.1138	.0024
2	.1094	.1088	.0006
3	.1151	.1043	.0108
4	.0846	.1003	-.0157
5	.0948	.0966	-.0018
6	.0981	.0933	.0048
7	.0688	.0903	.0215*
8	.0823	.0875	-.0052
9	.1230	.0850	.0380*

*difference significant at .05 level

Among profitable firms, the frequency of occurrence of zero is substantially *greater* than expected, indicating a tendency to round up to some threshold, adjusting results so that, for example, $4.0 million can be reported as opposed to some lower number. Also interesting is the greater than expected occurrence of fives in the second digit, coupled with the fewer than expected occurrence of fours, a result which indicates that rounding may occur at numbers other than zero.

Summary And Discussion

Earlier studies of U.S. and Australian firms have demonstrated that reported net earnings may be subject to some manipulation in the form of rounding or income smoothing. This study extends that research to a six country sample of Asian firms and, through the application of digital analysis, finds anomalous patterns in earnings similar to those found elsewhere.

Our results found that the zero occurred as a second digit more frequently than would be expected under Benford's Law. Further investigation revealed that this finding was entirely attributable to the profitable firms in the sample. In fact, slightly *fewer* than expected zeros were observed for the unprofitable firms.

Similarly, more fives were observed in the sample than would be expected under Benford's Law. This result was entirely due to the positive income firms in the sample. Again, slightly *fewer* than expected fives were found among the negative income firms.

Analysis of the unprofitable firms revealed that their reported income exhibited a higher than expected frequency of nines in the second digit. The similar finding for the sample as a whole was entirely attributable to this subgroup, as no significant difference was observed among the profitable sample firms.

Deviations from expected frequencies cannot, by themselves, provide direct evidence of irregularities or income manipulation. However, the findings are consistent with prior theories regarding income smoothing behavior, as well as prior findings regarding unusual patterns in reported earnings. At a minimum, the results reported here provide evidence that digital analysis can be applied to accounting data, irrespective of the country of the firm involved. Indeed, the findings of this study indicate that Benford's Law and other digital analysis tools may be valuable no matter what country, currency, or culture is being examined. 🕮

References

1. Aharony, J., Lee, C. W. J., and T. J. Wong. 2000. Financial Packaging of IPO Firms in China. *Journal of Accounting Research* 38:1 (Spring): 103-126.
2. Benford, F. 1938. The law of anomalous numbers. *Proceedings of the American Philosophical Society* (March): 551-572.
3. Beattie, V., Brown, S., Ewers, D., John, B.,Manson, S., Thomas, D., and M. Turner. 1994. Extraordinary items and income smoothing: A positive accounting approach. *Journal of Business Finance and Accounting* 21 (September): 791-811.
4. Carslaw, C. A. P. N. 1988. Anomalies in Income Numbers: Evidence of Goal Oriented Behavior. *The Accounting Review* (April): 321-327.
5. Gabor, A., and C. W. J. Granger. 1966. Price as an Indicator of Quality: Report on an Enquiry. *Economica* (February): 43-70.
6. Thomas, J. K. 1989. Unusual Patterns in Reported Earnings. *The Accounting Review* (October): 773-787.
7. Walsh, P., R. Craig and F. Clark. 1991. A big bath accounting using extraordinary items adjustment: Australian empirical evidence. *Journal of Business Finance and Accounting* 18 (January): 173-189.
8. Watts, R. L., and J. L. Zimmerman. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Notes