WINDOW-DRESSING OF FINANCIAL REPORTS: EVIDENCE FROM FINANCIAL FIRMS

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Abstract

Using Benford's law, this study documents pervasive evidence that managers of U.S. financial firms tend to engage in earnings manipulative activities of rounding earnings numbers to achieve key reference points. Consistent to prior studies, we find that the first digit is often emphasized by management in window-dressing the earnings numbers. More importantly, we find that key reference points are not limited to the first digit. The second, third, fourth, or even fifth digits are sometimes used as the reference points of rounding earnings. Our empirical results further show that the incentives of rounding earnings numbers are negatively associated with the distance of pre-rounded earnings to the reference point. Specifically, the greater the magnitude of the distance of pre-rounded earnings to the key reference point, the less likely management chooses to round earnings to achieve that point. The findings of the study have significant implications to the corporate control mechanisms of firms, especially to the roles of external auditors and the audit committees.

Keywords: earnings management, window-dressing, benford's law

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I. Introduction

Earnings management is the manipulation of accounting numbers within the scope of the generally accepted accounting principles (GAAP).[1] Since earnings have been regarded as the most important item in the financial reports to investors, analysts, boards, and senior executives, standard setters are very concerned with how earnings numbers are derived (Burgstahler and Dichev 1997; Beaver 1998). In his speech delivered to New York University in 1998, Arthur Levitt, former Chairman of the SEC, warned that earnings management by corporate America is eroding the quality of the financial reporting process. Following the debacle of Enron and WorldCom, earnings management has attracted substantial attention from regulators, accounting academics, and investment community. The passage of Sarbanes-Oxley Act in 2002 is one significant step toward aiming at enhancing the quality of financial statements. Meanwhile, it is important that more evidence be documented regarding the pervasiveness of earnings management.

One research stream on earnings management examines the distribution of reported earnings and hypothesizes that managers have incentives to round up reported earnings when the pre-rounded earnings are slightly below key cognitive reference points represented by $N \times 10^k$. Carslaw (1988) used Benford's law[2] to document an anomaly in the distribution of income numbers appearing in the financial statements of New Zealand firms. These numbers reflected a bias towards earnings numbers in excess of key cognitive reference points of $N \times 10^k$.

[1] Jackson and Pitman (2001) provide three definitions of earnings management. One definition is purposeful intervention in the external financial reporting process with the intent of obtaining some private gain. Another definition is an intentional structuring of reporting or production/investment decisions around the bottom line impact. A third definition is the use of judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the firm, or to influence contractual outcomes that depend on reported accounting judgments. Dechow et al. (1996) consider earnings management (management fraud) as earnings manipulation within (outside) the bounds of GAAP. For a review of literature on earnings management, refer to Schipper and Vincent (2003), and Healy and Wahlen (1999).

[2] Formulated by Benford (1938), Benford's law has recently been used to detect irregularities and tax evasions (see Nigrini and Mittermaier 1997; Nigrini 1994, 1996). A mathematically rigorous proof of Benford's law has unfortunately proven elusive. This is in part due to the fact that certain datasets, e.g., random numbers, do not follow Benford's law (Leemis, Schmeiser and Evans 2000).

Carslaw's work provides evidence of rounding earnings upward when earnings are just below the reference points denoted by $N \times 10^{k}$. Thomas (1989) extended Carslaw's (1988) study by investigating the rounding of earnings phenomenon of the U.S. firms. Thomas' results confirm that similar patterns are not peculiar to New Zealand firms. More recently, Skousen et al. (2004) found that Japanese firms also tend to round reported earnings. In another study, Kinnunen and Koskela (2003) examined the rounding phenomenon among 18 countries and found extensive evidence of the rounding behavior worldwide. In this study, we refer to such rounding behavior of earnings as *window-dressing* of financial reports.

However, at least two issues have not been completely resolved in this vein of research. First, the first digit may not be the only digit that is emphasized by the financial statement users. From the marketing perspective, a listed price of a car at $12,995 focuses on the second digit. Also, Brenner and Brenner (1982) report that the gas station per gallon price of gasoline listed at $\$1.53^{9/10}$ is almost always quoted at $1.53, when obviously the price is significantly closer to $1.54. In this case, the third digit becomes the reference point. Finally, if the executive bonus plan of a firm requires a 10 percent increase over current earnings of, say, $110,000, it is unlikely that the management will focus on the first digit of the benchmark (i.e., $121,000). In this case, it is more likely that the second or even the third digit will be emphasized when the management reports the earnings numbers.

Another unsolved issue is whether the incentives to round earnings numbers are negatively associated with the distance from the reference point. In other words, is the rounding behavior affected by the amount of effort needed to achieve the reference points? For example, if the reference point is the second digit, does the management have the same incentive to round earnings of $121,000 to $130,000 (a 7.44 percent increase) as opposed to round $129,000 to $130,000 (a 0.78 percent increase)? From the management's perspective, the extent of earnings management is likely to be a function of the costs of manipulative effort and the perceived benefits of achieving the benchmark (Burgstahler and Dichev 1997). If the benefits of rounding do not justify the costs of earnings manipulation, the management may decide not to report round earnings.

A further motivation of this study is that, while earnings management has been examined extensively in the accounting literature, there is surprisingly little effort exerted particularly on the financial firms. One often cited reason is that since financial firms face different regulations on their accounting practices, the accounting numbers of financial firms may mean differently from firms in other industries. Thus, pooling financial firms and firms in other industries could add potential noise in the statistical analysis. Another reason relates to the scaling effect of financial firms in estimating the accrual models. Healy and Wahlen (1999) observed that most earnings management studies employ various accrual models to test the researchers' earnings management hypothesis. However, these models invariably use total assets as the scaler of other financial variables. Since financial firms are, by formation, highly leveraged, using total assets as the scaler tend to make earnings management less likely to be detectable by the accrual models. As a result, most earnings management studies choose to exclude financial firms in their analysis. However, there is evidence suggesting that earnings management or fraud may also be pervasive among these firms. For example, a study by the Association of Fraud Examiners (1996) found that the median amount of employee fraud incidents was the highest in the financial firms as compared to any other industry. Thus, it is possible that earnings management, especially the window-dressing of financial reports, is also a noticeable practice among the financial firms. The purpose of this paper is to use Benford's law to investigate the rounding behavior of income numbers among U.S. financial firms. Our empirical results suggest that reporting rounded earnings is a pervasive phenomenon among the firms. Consistent with prior studies, we find that the first digit in earnings numbers is often emphasized by the firms. More importantly, we find that the second digit, third digit, fourth digit, or even the fifth digit in earnings numbers sometimes serves as the reference point of the rounding behavior. Our empirical results further show that the greater the magnitude of the distance of pre-rounded earnings to the key reference point, the less likely management chooses to round earnings to achieve that point.

The findings of our study have important implications to the corporate governance functions of the financial firms. In particular, if a rounded earnings number is observed, the auditor and the audit committee should be concerned about why such number is reported. Does the management intend to manipulate the perception of the market participants regarding the value of the firm's stocks? Or does the management intend to use the rounded earnings number to affect the outcome of various contracts, e.g., debt covenants, or the incentive compensation plans? The answer to the latter question is particularly important since although the details of these contracts are not observable by the researchers, they are observable by the auditor and the audit committee. If the auditor and the audit committee have determined that the rounded earnings number is not reflecting the real economic performance of the firm, they can then look for the areas where the management could have used to attain the reported number.

The rest of the paper proceeds as follows. Section II describes the hypotheses and mathematical model of our study, while Section III presents the data analysis and results. Section IV summarizes the study.

II. Prior Literature and Hypotheses

Benford (1938) demonstrated that, contrary to our intuition, the expected distributions of naturally occurred numbers are skewed towards one for the first digits (since zero cannot be a first digit) and zero for the second digit. Table 1 shows the expected occurrences of each digit in the first and second places. [See appendices, Table 1].

Benford postulated that the expected proportions or occurrence of a number as the first digit in a number series can be approximated by the following relation:

$$proportion\ (a\ is\ the\ first\ digit) = Log_{10}(a+1) - Log_{10}(a) \quad (1)$$

Further, the expected proportion of a given number *a* as the first digit and the number *b* as the second digit can be found in the following relation:

$$\mathrm{Log}_{10}\left(a + \frac{b+1}{10}\right) - \mathrm{Log}_{10}\left(a + \frac{b}{10}\right). \quad (2)$$

Using the above equations and summing over all possible *a* values for any *b* value gives an overall expected proportion for *b* as the second digit. This equation is as follows:

proportion (*b is the second digit*) =

$$= \sum\left(\mathrm{Log}_{10}\left(a + \frac{b+1}{10}\right) - \mathrm{Log}_{10}\left(a + \frac{b}{10}\right)\right). \quad (3)$$

The expected proportion of the numbers in the third, fourth, fifth digit and so on can be similarly derived.

To explain why Benford's law applies to many types of data that describe the relative sizes of similar phenomena, such as market values, net income, or daily trading volumes of NYSE firms, Nigrini and Mittermaier (1997) used the following example of the growth of population:

"An intuitive explanation is to consider a city with 100,000 people (the population has a first digit 1) growing at *x* percent per year. The first digit will persist until the population has grown by 100 percent (to 200,000). Once at 200,000 only a 50 percent increase is needed for a change to the first digit. At 900,000 only an 11.1 percent increase is needed for the first digit to change to a 1 (a population of 1,000,000)." (Nigrini and Mittermaier 1997, page 54)

From the above example we would expect a higher number of one's in the first digit than two's, and three's and so on in the time-series of the population of any given city. Taking one small step further, when pooling the historical population size of a vast number of cities and ordering these numbers, we would expect that the resulting list of population numbers forms a geometric sequence, as predicted by Benford's law.

An important similarity between earnings numbers and the population of cities is that both can be considered to be growing at a relatively stable rate. If this is the case, then a list of earnings numbers, in the absence of managerial effort to round them, should also conform to Benford's law.

The assumption of stable growth rates of earnings is supported by both the income-smoothing literature and the equity valuation models. First, the income-smoothing literature suggests that management tends to report earnings that produce a smoothed trend (Carslaw 1988). Second, many equity valuation models used by security analysts explicitly assume a constant growth rate for a firm's fundamental attributes (e.g., future earnings, dividend payouts, and free cash flows) in calculating the terminal value of the firm's equity security (Penman 1998, Penman and Sougiannis 1998, and Francis et al. 2000). It is therefore reasonable to believe earnings, *on average*, grow at a stable rate in the long run and, in the absence of managerial effort to round earnings, conform to Benford's law.

However, Thomas (1989) proposed two general reasons why managers may choose to round earnings numbers and consequently, certain digits in the earnings numbers may not conform to the Benford's law. One reason relates to earnings numbers as key cognitive reference points in the eyes of financial statement users. The pricing phenomenon of "$1.99" in marketing suggests that consumers view a product priced at $1.99 to be significantly cheaper than a product priced at $2.00. This perceptual discontinuity is most likely caused by the biological constraint that human beings have only a limited amount of memory, which tends to store the most relevant bits of information about a price (Brenner and Brenner 1982). Thus, in the eyes of a consumer, a price of $698 is more likely to be "six hundred something" rather than "almost seven hundred." This is because the process of rounding up is more complex than that of rounding down (Carslaw 1988). Similarly, earnings of $698,000 may be perceived by investors to be much lower than $700,000. Therefore, if lower perceived current earnings change the investors' expectation of the distribution of future earnings, which leads to lower share prices, managers have incentives to report round earnings numbers in the desire to change the behavior of the investors.

The use of contracts provides another reason why managers occasionally round earnings numbers. Due to uncertainty related to managers' productive efforts, budgeting, lending, and compensation contracts tend to be based on *ex ante* estimates and rounded to rough figures that emphasize the *first* digit in the contractual number (Carslaw 1988). Thus, small changes in such contractual parameters may have a large cash flow effect (Thomas 1989).

If managers manipulate earnings so that earnings numbers achieve certain key reference points, we would expect to observe abnormal distribution of the digits in the next place of the reference points. For example, if the key point is the second digit of positive earnings and the management tends to round earnings up to achieve this point, we expect that there are more zeros and fewer nines in the third place of earnings numbers. Formally, our first hypothesis is stated as follows (in the null form):

H_1: The occurrence of numbers in the next place of key reference points in income numbers will conform to the expected distribution and there will be

no evidence of managerial efforts to round earnings numbers.

The alternative hypothesis posits that the occurrence of digits in the next place of the reference points in earnings numbers does not conform to the expected distribution and there is evidence of managerial efforts to round earnings numbers. Specifically, we expect to observe an abnormally high frequency of number zero and an abnormally low occurrence of number nine in these places of earnings numbers. Additionally, if the rounding occurs at a larger amount, we would observe an abnormally low occurrence of number eight and/or seven in these places of earnings numbers. As discussed earlier, the distance to the reference point may be negatively associated with the managerial effort to manipulate earnings to achieve that point. Since earnings manipulation behavior is likely a function of the perceived benefits of reporting the target result and the costs of distorting pre-rounded earnings to achieve that result, if the distance to the reference point is large, the benefits of achieving the benchmark may not justify the costs of earnings manipulation to cover this distance. Therefore, management may choose to round up earnings if the distance to the reference point is small, and not to report rounded earnings when the distance is large. Formally, the second hypothesis is stated as follows:

H_2: The managerial effort to round earnings numbers is negatively associated with the distance between earnings before manipulation and the reference points.

In order to test our hypotheses, we need to identify the expected proportions of each of the ten digits (zero to nine) in each place of earnings numbers under the null hypothesis. Unfortunately, the true distribution of the digits in the absence of managerial manipulation of reported earnings is not publicly observable (Thomas 1989). Therefore, we need an approximation for this distribution. Benford's law provides such an approximation (Carslaw 1988).

To test our null hypothesis of no managerial effort to round earnings, we compared the observed frequency for each number x in various places of earnings numbers to the expected occurrences of the number as predicted by Benford's law (equations (1) through (3)). To perform a significance test of the observed deviations from the expected proportions, we used a normally distributed Z-statistic:

$$Z=\frac{|p-p_0|-\frac{1}{2n}}{\sqrt{\frac{p_0(1-p_0)}{n}}} \qquad (4)$$

where p and p_0 are the observed and expected proportions, respectively. The sample size is represented by n. The second term in the numerator is a correction term, and should be applied only when it is smaller than $|p - p_0|$ (Thomas 1989). These Z-statistics would reject the null hypothesis at the ten, five, and one percent level if their values exceed 1.64, 1.96, and 2.57, respectively.

III. Empirical Results

Data

Data used in this study are obtained from the 2006 version of Standard & Poor's *Research Insight* database. The analysis includes annual net incomes of both active and inactive financial firms listed on NYSE, ASE and NASDAQ. Financial firms are identified using the standard industrial code (SIC) between 6000 and 6999. The final sample consists of 36,359 annual positive earnings observations. We also examine the negative earnings numbers and do not find abnormal deviations from the Benford's law. Therefore, our analysis will focus on the positive earnings numbers.

Test of Hypothesis 1

Our first hypothesis predicts an abnormally high frequency of number zero and an abnormally low frequency of number nine in the next place of reference points of earnings numbers. Additionally, if the rounding occurs at a larger amount, we would observe an abnormally high occurrence of number one and/or two, and an abnormally low occurrence of number eight and/or seven in these places of earnings numbers.

Table 2 reports the distributions of each digit (0 to 9) appearing in the second, and first two places of net incomes. The first number in each cell of the table represents the difference between the actual and expected proportion of the sample (in terms of a percentage of the sample). The second number is the proportion predicted by Benford's law, and the last number (italicized) is the Z-statistic. [See appendices, Table 2]. We first look at the distribution of digits in the second place of earnings. This to replicate prior studies that assume managers used key cognitive reference points of $N \times 10^k$, i.e., the left-most digit of earnings numbers. Consistent to those studies (especially Thomas 1989), our results show that the proportion of zeros as the second digit, expected to be 11.97 percent of the sample, is actually higher by 0.97 percent. Table 2 also reveals a systematic lack of nines in the second place of earnings. The proportion of nines, expected to be 8.5 percent of the sample, is actually lower by 0.61 percent. While both deviations are statistically significant, they are smaller in magnitude than in Thomas (1989) who used the whole sample of public companies in the US. Specifically, Thomas reported a deviation of +1.09 percent for zeros in the second place and –0.76 percent for nines.

Since it is possible that some firms may have emphasized on the reference points other than the first (left-most) digit, table 2 also reports the distribution of digits in other places of earnings numbers. Consistent with our expectations, there are significantly more zeros and fewer nines in the third, fourth, fifth, and even sixth place, suggesting that firms may also use the second, third, fourth, and fifth digit as the reference point. More importantly, the deviation of zero in the third place (1.85 percent), fourth place (1.96 percent) and fifth place (1.59 percent) is much greater than zero in the second place (0.97 percent), suggesting that the rounding behavior focusing on the second, third and fourth digit as the reference point occurs more often than the first digit as the reference point. Furthermore, we notice that rounding is not limited to cases with nines in the third, fourth and fifth digit. Some firms tended to round earnings when these places are 8 or even 7. Empirically, the negative deviations of 8 from the expected proportion are significant at less than 1 percent in these places. Finally, the rounding sometimes does not stop at 0 in the place next to the reference point. Digit 1 often served as the stopping point in the third, fourth and fifth place of the earnings. This result suggests that firms sometimes manipulate earnings at a larger amount to surpass the reference points. Overall, the above results confirm our expectation that the reference points used by management of firms in reporting earnings numbers are not limited to the left-most digit. The second, third, fourth and even fifth digits of earnings numbers may also have been used by management as the reference points. While it is relatively easy to comprehend that the second and third digits are sometimes emphasized by customers or investors, it is not intuitively appealing why the fourth and fifth digit is also important (this is for the case that we observe more zeros and fewer nines in the fifth and sixth place of earnings). Another unanswered issue is whether the rounding behavior is independent of the reference points emphasized. For example, if we observe $802,000, we do not know whether management is focusing on the first digit or the third digit, or both. Thus, we are unable to construct a test to examine the conjecture of Brenner and Brenner (1982) that consumers place progressively less emphasis on the second, third, and fourth digit, and so on.

Test of Hypothesis 2

Hypothesis 2 posits that the managerial effort of rounding earnings is negatively associated with the distance of pre-rounded earnings to the next reference point. For example, if the reference point is the second digit, rounding from $421,000 to $430,000 requires more earnings manipulating effort than from $429,000 to $430,000. Thus, if the benefits of rounding up do not justify the costs of earnings manipulation, management may decide not to round up if the earnings number is $421,000, and round up to $430,000 if the earnings number is $429,000. If this is the case, we can expect to observe more zeros in the third place when the second digit is 3, and fewer nines in the third place when the second digit is 2. In general, under hypothesis 2, we expect that for positive earnings there are more low digits (e.g., zeros and ones) in the third place when the second place is digit *m*, and more high digits (e.g., eights and nines) in the third place when the second place is digit *m*-1.

Table 3 reports the distribution of the third digits conditional upon the second digits in positive earnings. Consistent with our expectations, there are more zeros and ones in the third place of earnings numbers when the second digit is *m*, and fewer eights and nines in the third place when the second digit is *m*-1 (with the exceptions of third digit being 9 when second digit is 4, 6 and 7). For example, when the second digit is 3, there are 1.35 percent more zeros in the third place than expected. On the other hand, when the second digit is 2, there are 1.49 fewer nines in the third place than expected. This evidence suggests that when the distance to the next reference point is large, management tended to decide not to round up the earnings numbers, but did round up when the distance is small. This result, however, does not exclude the possibility that management did not round up earnings *at all* when the distance is large. This possibility is less likely since the deviation of zeros in the third place when the second place is *m* is systematically greater than that of eights and nines in the third place when the second place is *m*-1.

Thus, while managers tended to round earnings up when the distance to the next reference point is small, they tended not to round up when the distance is large. [See appendices, Table 3].

IV. Summary and Conclusions

This study documents pervasive evidence that managers of U.S. financial firms tend to round earnings numbers to achieve key reference points. Similar to Thomas (1989), we find that the first digit of earnings numbers is often emphasized by management. We also find that key reference points are not limited to the first digit. The second, third, fourth and even fifth digits are sometimes used as the reference points of the rounding earnings behavior. Finally, our results show that the incentives of rounding earnings numbers are negatively associated with the distance of pre-rounded earnings to the next reference point.

There are two competing, but not mutually exclusive, explanations for this phenomenon. From the valuation perspective, Carslaw (1988) argued that the $1.99 pricing phenomenon describes the managers' perceptions of how stock is valued, and small changes in reported earnings around the key reference points have large effects on firm value. From the contracting perspective, Thomas (1989) argued that it is likely that budget or lending and compensation contracts are denominated in round earnings numbers. Although we do not isolate the effect of the valuation or contracting perspective, it would be beneficial for future research to identify conditions under which these effects can be individually examined.

However, this study does not examine which earnings components are most likely managed or the general means employed by the management to achieve the target reported earnings. This is important to various stakeholders involved in the contracts with the firms or the investors whose investment decisions are based on whether management meets or fails to meet its earnings forecasts. If management "successfully" achieves these benchmarks, the interested parties should look into the most likely manipulated accounts for evidence whether management has been involved in earnings manipulative activities. Although there is little empirical evidence that the rounding earnings behavior is a harmful practice, future research may focus on the means used by management to round earnings numbers and the effect of such behavior on the decision making of the financial statement users.

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Appendices

Table 1. Expected Frequency Occurrences for Each Digit in the First and Second Places

Digit	First Digit Expected Frequency Percent	Second Digit Expected Frequency Percent
0	---	11,968
1	30,103	11,389
2	17,609	10,882
3	12,494	10,433
4	9,691	10,031
5	7,918	9,668
6	6,695	9,337
7	5,799	9,035
8	5,115	8,757
9	4,576	8,500

Source: Nigrini and Mittermaier (1997).

Table 2. Distribution of the Second through the Sixth Digit in Annual Earnings

	0		1		2		3		4		5		6		7		8		9	
Second digit																				
Observed Deviation	0.97	***	0.2		0.15		0.1		-0.17		-0.12		-0.1		-0.21		-0.24		-0.61	***
Expected Proportion	11.97		11.39		10.88		10.43		10.03		9.67		9.34		9.04		8.76		8.5	
Z-statistics	*5.72*		*1.18*		*0.92*		*0.6*		*1.06*		*0.72*		*0.6*		*1.35*		*1.6*		*4.14*	
(n = 36,359)																				
Third digit																				
Observed Deviation	1.85	***	0.53	***	0.10		0.30	*	-0.46	***	0.16		-0.25		-0.30	*	-0.70	***	-1.21	***
Expected Proportion	10.18		10.14		10.10		10.06		10.02		9.98		9.94		9.90		9.86		9.83	
Z-statistics	*11.51*		*3.30*		*0.62*		*1.89*		*2.89*		*0.98*		*1.56*		*1.93*		*4.44*		*7.69*	
(n = 35,563)																				
Fourth digit																				
Observed Deviation	1.96	***	0.68	***	0.17		0.41	**	-0.48	***	0.17		-0.32	*	-0.36	**	-0.79	***	-1.45	***
Expected Proportion	10.02		10.01		10.01		10.01		10.00		10.00		9.99		9.99		9.99		9.98	
Z-statistics	*11.57*		*3.99*		*1.02*		*2.40*		*2.81*		*0.98*		*1.86*		*2.10*		*4.66*		*8.54*	
(n = 31,327)																				
Fifth digit																				
Observed Deviation	1.59	***	0.63	***	0.36		0.67	***	-0.58	**	0.03		-0.15		-0.26		-1.03	***	-1.25	***
Expected Proportion	10.00		10.00		10.00		10.00		10.00		10.00		10.00		10.00		10.00		10.00	
Z-statistics	*7.00*		*2.76*		*1.57*		*2.96*		*2.56*		*0.11*		*0.67*		*1.14*		*4.53*		*5.51*	
(n = 17,425)																				
Sixth digit																				
Observed Deviation	0.80	*	0.92	**	0.72	*	1.19	***	-0.99	**	-0.18		-0.65		-0.34		-0.65		-0.82	*
Expected Proportion	10.00		10.00		10.00		10.00		10.00		10.00		10.00		10.00		10.00		10.00	
Z-statistics	*1.85*		*2.13*		*1.65*		*2.76*		*2.28*		*0.41*		*1.51*		*0.79*		*1.51*		*1.89*	
(n = 4,815)																				
The observed deviation and expected proportion are measured as the percentage of the sample.																				
*, **, ***: Significant at the 0.10, 0.05 and 0.01 level, respectively (two-tailed test).																				

Table 3. Distribution of the Third Digit Conditional on the Second Digit in Positive Annual Earnings

	Third Digit																			
Second Digit	0		1		2		3		4		5		6		7		8		9	
	2.48	***	1.52	***	0.02		0.31		-1.00	**	-0.13		-0.62		0.30		-1.08	**	-1.79	***
0	10.24		10.18		10.13		10.08		10.02		9.97		9.92		9.87		9.82		9.77	
(n=4,623)	*5.56*		*3.42*		*0.04*		*0.69*		*2.27*		*0.29*		*1.41*		*0.68*		*2.47*		*4.10*	
	1.84	***	0.17		-0.89	*	0.85	*	-0.19		0.42		-0.05		-0.46		-0.58		-1.12	**
1	10.22		10.17		10.12		10.07		10.02		9.97		9.93		9.88		9.84		9.79	
(n=4,129)	*3.91*		*0.37*		*1.90*		*1.82*		*0.40*		*0.89*		*0.10*		*0.99*		*1.26*		*2.42*	
	1.45	***	0.25		0.34		0.49		-0.33		-0.13		-0.19		-0.76		0.38		-1.49	***
2	10.20		10.15		10.11		10.06		10.02		9.98		9.93		9.89		9.85		9.81	
(n=3,932)	*3.00*		*0.51*		*0.72*		*1.02*		*0.69*		*0.28*		*0.40*		*1.60*		*0.79*		*3.14*	
	1.35	***	0.48		0.20		0.30		-0.25		0.14		0.44		-0.13		-1.00	**	-1.52	***
3	10.19		10.14		10.10		10.06		10.02		9.98		9.94		9.90		9.86		9.82	
(n=3,737)	*2.72*		*0.97*		*0.41*		*0.60*		*0.51*		*0.28*		*0.91*		*0.27*		*2.05*		*3.13*	
	0.80	*	0.81	*	0.36		-0.11		-0.87	*	-0.09		0.18		-0.41		-0.63		-0.03	
4	10.17		10.13		10.09		10.06		10.02		9.98		9.94		9.90		9.87		9.83	
(n=3,509)	*1.65*		*1.67*		*0.72*		*0.22*		*1.72*		*0.18*		*0.35*		*0.82*		*1.26*		*0.05*	
	2.66	***	0.19		0.17		-0.15		-0.67		-0.05		-0.07		-0.27		-0.74		-1.08	**
5	10.16		10.13		10.09		10.05		10.02		9.98		9.95		9.91		9.88		9.84	
(n=3,392)	*5.13*		*0.37*		*0.33*		*0.28*		*1.30*		*0.09*		*0.13*		*0.53*		*1.44*		*2.12*	
	1.46	***	0.01		0.77		1.02	*	-0.83		0.57		-0.65		-0.46		-1.16	**	-0.73	
6	10.15		10.12		10.08		10.05		10.02		9.98		9.95		9.92		9.88		9.85	
(n=3,289)	*2.77*		*0.01*		*1.47*		*1.94*		*1.59*		*1.09*		*1.24*		*0.88*		*2.22*		*1.40*	
	2.40	***	0.80		0.10		0.20		-1.01	*	0.10		-0.54		-0.50		-0.79		-0.76	
7	10.15		10.11		10.08		10.05		10.02		9.98		9.95		9.92		9.89		9.86	
(n=3,133)	*4.45*		*1.49*		*0.19*		*0.37*		*1.89*		*0.19*		*1.00*		*0.94*		*1.48*		*1.43*	
	1.93	***	0.57		-0.79		0.27		0.53		0.10		-1.06	*	0.39		-0.77		-1.17	**
8	10.14		10.11		10.08		10.05		10.01		9.98		9.95		9.92		9.89		9.86	
(n=3,025)	*3.51*		*1.04*		*1.44*		*0.49*		*0.97*		*0.18*		*1.95*		*0.72*		*1.42*		*2.16*	
	2.07	***	0.17		0.95	*	-0.41		0.33		0.86		-0.01		-0.91		-0.70		-2.35	***
9	10.13		10.10		10.07		10.04		10.01		9.98		9.96		9.93		9.90		9.87	
(n=2,794)	*3.63*		*0.30*		*1.67*		*0.73*		*0.58*		*1.52*		*0.01*		*1.60*		*1.24*		*4.17*	

*, **, ***: Significant at the 0.10, 0.05 and 0.01 level, respectively (two-tailed test).
The first number in each cell represents the deviation from expected proportions. The other two numbers report the expected proportions and Z-statistic (in italics). The expected proportion of the third digit is the conditional probability on the second digit. For example, of the 21,635 observations that have digit 1 in the second place, approximately 10.12 percent has digit 2 in the third place. In this case, the conditional probability of digit 2 in the third place when digit 1 is in the second place is calculated as the sum of the probabilities of 112, 212, 312,…, 912 divided by the probability of digit 1 in the second place.